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Images that engage communities in sustainable urban stormwater management

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Abstract

This thesis investigated the effect of still images (i.e., photographs) on engagement with a pro-environmental topic. A combination of exploratory (i.e., Q-methodology) and experimental study designs were used. By drawing on the elaboration likelihood model and appraisal theories of emotion, the research tested whether discrete emotions, elicited by an image and embedded within a related written text, influence message processing and, in turn, cognitive, affective, and behavioural engagement with the message topic. Research has only begun to assess the effect of discrete emotions on depth of processing. These early findings suggest that emotions that differ with regard to the cognitive appraisal of certainty will have differential effects on depth of processing. However, this nascent research has largely focused on incidental rather than integral emotions and has not examined the role of images as the antecedent to the emotion elicited. This thesis aims to fill this gap by assessing how related, emotive images influence depth of processing and overall engagement.

Chapter 2 presents the results of a Q-method study that assessed community members' (N = 23) responses to categories of context-relevant images in terms of emotional response, personal relevance, and topic congruence. The study found that although images of oceans elicited positive emotions (e.g., serenity), most participants did not perceive such images as being relevant to the topic of stormwater management. Images of traditional stormwater infrastructure evoked negative emotions (e.g., disgust), and were perceived as topic congruent but not personally relevant. Images of flooding were rated as relevant, but also as distressing for the majority of the participants.

While an important first step, the results of exploratory research cannot establish the causal effect of the emotions elicited by images. Therefore, Chapters 3 and 4 present the results of four studies that empirically tested the causal effect of images that elicit integral disgust, sadness or serenity on processing of environmental management information.

Chapter 3 describes the results of two experimental studies (N = 235 and N = 388) using messages with images that elicited either disgust (Study 2 and Study 3) or sadness (Study 3) in comparison to a control condition that included no image. For people with lower levels of environmental identity, the disgust image conditions indirectly led to lower overall engagement with the message content via lower depth of processing, in comparison to both a control condition that included no image (Study 1 and Study 2) and a sad image condition (Study 2). Contrary to what was predicted, the effect of the sad image did not increase depth of processing relative to the control condition (Study 2). Overall, the studies indicate that for

people who do not identify strongly with pro-environmental issues, the presence of disgusting images can lower the degree to which they pay attention to the content of the message and this flows on to their overall engagement with the message topic.

Chapter 4 describes the results of two experiments (N = 384 and N = 394) that were designed to test the effect of images that elicit serenity. Study 4 found that serenity leads to lower depth of processing for people with low environmental identities. Participants with stronger environmental identities, however, responded differently. That is, contrary to what was expected, the sad image led to lower overall engagement with the message topic via depth of processing. The results suggest that when messages are more personally relevant, recipients move away from using the elicited emotion as a peripheral cue and instead process the content of the message in-line with the motivation goal of the emotion elicited (i.e., a reduction in sadness). The results suggested that it is important that the message content not only describe the problem but must also emphasise the solutions.

The final experiment conducted as part of the thesis, Study 5, aimed to re-test the hypotheses proposed in Study 4 using a new factsheet that included efficacy response information. This was done to test whether the inclusion of efficacy information ameliorates the negative effect of sadness on depth of processing and engagement. Contrary to what was predicted, depth of processing did not vary across the tested image conditions. The lack of significant differences between the conditions was attributed to high personal involvement of participants with the factsheet topic (i.e., plastic pollution in oceans) at the time of data collection. This finding again suggests that emotions may serve as a peripheral cue that influences depth of processing primarily when the topic is of low involvement.

In sum, this thesis contributes to the fields of social and environmental psychology by extending theoretical frameworks of emotion and cognition by testing whether the findings from incidental emotion research generalise to the context of integral emotions. The findings also extend the literature by testing visual images as antecedents to a felt emotion. Together, the results highlight the danger of using images eliciting serenity and disgust in environmental messaging, particularly if levels of involvement are expected to be low within the target audience: these images are then in danger of leading participants to disengage from the message rather than attending to the information as desired.

Declaration by author

This thesis is composed of my original work, and contains no material previously published or written by another person except where due reference has been made in the text. I have clearly stated the contribution by others to jointly-authored works that I have included in my thesis.

I have clearly stated the contribution of others to my thesis as a whole, including statistical assistance, survey design, data analysis, significant technical procedures, professional editorial advice, financial support and any other original research work used or reported in my thesis. The content of my thesis is the result of work I have carried out since the commencement of my higher degree by research candidature and does not include a substantial part of work that has been submitted to qualify for the award of any other degree or diploma in any university or other tertiary institution. I have clearly stated which parts of my thesis, if any, have been submitted to qualify for another award.

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Tracy Schultz
9th October 2018

Publications during candidature

Schultz, T., Fielding, K., & Newton, F. (2016, February). *Using photographic imagery to connect people with sustainable urban stormwater management.* Paper presented at the Young Water Professionals conference, University of New South Wales, Sydney.

Fielding, K. S., Dolnicar, S., & **Schultz, T.** (2018). Public acceptance of recycled water. *International Journal of Water Resources Development*, 1-36. doi:10.1080/07900627.2017.1419125

Schultz, T., Fielding, K., & Newton, F. (2018). Images that engage people with sustainable urban stormwater management. *Science Communication, 40*(2), 199-227. doi:10.1177/1075547018760902

Schultz, T., Fielding, K., Newton, F., & Louis, W. (2018). The effect of images on community engagement with sustainable stormwater management: the role of integral disgust and sadness. *Journal of Environmental Psychology*, *59,* 26-35. doi.org/10.1016/j.jenvp.2018.08.003.

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Contributor	Statement of contribution
Schultz, T. (Candidate)	Conception and design (60%) Analysis and interpretation (80%) Drafting and production (100%)
Fielding, K.	Conception and design (20%) Analysis and interpretation (10%) Review and feedback (45%)
Newton, F.	Conception and design (20%) Analysis and interpretation (10%) Review and feedback (45%)
Louis, W.	Review and feedback (10%)

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Newton, F.	Conception and design (20%) Analysis and interpretation (10%) Review and feedback (40%)

Contributor	Statement of contribution
Louis, W.	Analysis and interpretation (5%) Review and feedback (20%)

Contributions by others to the thesis

My primary advisor, Associate Professor Kelly Fielding, provided guidance on theory, was involved in the conception and design of all the research studies, and assisted with the interpretation of the research data. My associate advisor, Dr Fiona Newton, also provided guidance on the theoretical framework, conceptual design and assisted with the interpretation of all included studies. My associate advisor, Professor Winnifred Louis, provided input to the design of the studies in Chapter 3 and 4 and assisted with the interpretation of the results for those studies. All three supervisors critically reviewed the thesis and all the manuscripts that comprise it.

Statement of parts of the thesis submitted to qualify for the award of another degree

None.

Research Involving Human or Animal Subjects

The research outlined in Chapter 2 received ethical clearance from the Institute for Social Science Research Higher Degree Ethical Review Committee on 26 March 2015 (approval number ISSR:26032015.EA05; see Appendix A).

The research outlined in Chapter 3 and 4 received ethical clearance from the School of Psychology Higher Degree Ethical Review Committee on 25 February 2016 (approval number 16-PSYCH-PHD-07-TS, see Appendix B).

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Keywords

images, emotions, message processing, engagement, environmental identity, elaboration likelihood model, action tendency framework

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CHAPTER 1

1.1. Introduction

> *"In the rank order of communications, only direct experience is more compelling than visual images. Ask people to recall when they first changed their mind about something significant and they rarely cite an argument: most often it is something they saw"(The Green Alliance, 2010, p. 39).*

Images can be an effective mechanism for engaging people with a topic (O'Neill, 2013; Sheppard, 2005; Smith & Joffe, 2013). They are particularly useful when communicating unfamiliar or complex concepts, as is often the case with pro-environmental issues (Larson & Edsall, 2010; O'Neill, Boykoff, Niemeyer, & Day, 2013; Trumbo, 1999). Indeed, images often play a central role in communications and appeals made by environmental interest groups (Doyle, 2007; Nicholson-Cole, 2005; O'Neill & Smith, 2014). For example, Greenpeace, arguably the world's most influential environmental organisation (Doyle, 2007), has successfully used highly emotive images of activists confronting looming whaling boats to galvanize public support for international whaling treaties (Mathiesen, 2015, June 11).

Images are also frequently used in traditional media (Powell, Boomgaarden, De Swert, & de Vreese, 2015; Smith & Joffe, 2014). In a review of climate change coverage in newspapers in the United Kingdom, for example, Smith and Joffe (2013) found that nearly two thirds of articles sampled included an image. Furthermore, the use of images is predicted to increase in importance with the growth of new media (i.e., websites and social media), which are heavily image focused (Anderson, 2015; Lazard & Atkinson, 2015; Powell et al., 2015).

O'Neill and Nicholson-Cole (2009) distinguish between mental imagery (that which is in a person's 'mind's eye') and external images such as those appearing in the media (e.g., documents, websites, billboards, newspapers, and the like). The thesis research focuses on the latter type of image. Specifically, the research draws on the Enser, Sandom, and Lewis (2005) taxonomy of images by using simple, direct pictures (i.e., photographs). The term 'images' will be used hereafter to refer to simple, direct pictures.

While the use of images is common in pro-environmental communication and the wider media, they are often treated as merely an add-on element to the message without due consideration of how they can influence overall message processing and engagement (Hansen & Machin, 2014; Lazard & Atkinson, 2015; Powell et al., 2015; Rensberger, 2002; Rodríguez

Estrada & Davis, 2015; Trumbo, 1999). Indeed, there is very little research establishing which images to use and which to avoid when communicating about pro-environmental issues (Braasch, 2013; Chapman, Corner, Webster, & Markowitz, 2016; Domke, Perlmutter, & Spratt, 2002; Hart & Feldman, 2016; Powell et al., 2015). Certainly, not all images are created equal: some are more likely to engage people with an issue than others, and some may even be detrimental (Akerlof, Rowan, Fitzgerald, & Cedeno, 2012; Leiserowitz, 2006; O'Neill & Nicholson-Cole, 2009). The lack of research on the effects of images has led to growing interest in identifying the types of images that engage people with pro-environmental messages.

Although the term engagement can be defined in different ways (Bauer & Jensen, 2011; Deiuliis, Donaldson, Herring, & Maglalang, 2011), for the purposes of this thesis, engagement is defined as a "personal state of connection with the issue…concurrently comprising cognitive, affective and behavioural aspects" (Breckler, 1984; Lorenzoni, Nicholson-Cole, & Whitmarsh, 2007, p. 446). That is, people are engaged to the extent that they have supportive attitudes towards the focal issue/policy (affective engagement), they hold accurate knowledge about the topic (cognitive engagement), and they are motivated to take action (behavioural engagement; Dean, Lindsay, Fielding, & Smith, 2016). This definition of engagement has been used in previous pro-environmental research (Dean, Lindsay, Fielding, & Smith, 2016; Lorenzoni et al., 2007; O'Neill & Nicholson-Cole, 2009). The importance of an engaged community to gain support for pro-environmental issues is well established in the literature (Colmar Brunton Social Research, 2005; Holmes, Blackmore, Hawkins, & Wakeford, 2011; James, Kelly, Brown, & Laffan, 2010; Maibach & Priest, 2009; Moser, 2010; National Water Commission, 2014; Wong & Brown, 2008).

1.2. Current research on the effect of pro-environmental images

Systematic evaluations assessing the influence of images used in pro-environmental communications are rare (Braasch, 2013; Domke et al., 2002; Hart & Feldman, 2016). Indeed, the dearth of image-related research is not just limited to pro-environmental communication; multiple reviews within the communication literature have identified a need to further explore the role of visual information (Geise & Baden, 2015; Griffin, 2001; Hart & Feldman, 2016; Schill, 2012). Research that has been conducted in pro-environmental contexts has almost exclusively focused on climate change communication (e.g., Braasch, 2013; Chapman et al., 2016; Greyson, 2006; Hart & Feldman, 2016; Nicholson-Cole, 2005; O'Neill et al., 2013; O'Neill & Nicholson-Cole, 2009; O'Neill & Smith, 2014). This body of research has demonstrated mixed results in that images were found to influence public opinion and engagement both positively and negatively. Moreover, this body of research focused

predominantly on two aspects of images that can influence engagement. That is, the research examined issue salience (e.g., whether the image makes people realise that climate change is important) and self-efficacy (e.g., the extent to which an image makes people feel like they can do something about climate change). For example, O'Neill and colleagues established that although familiar images of climate impacts (e.g., a polar bear on melting ice) engender high salience of the issue, they are also linked to a decreased sense of individual self-efficacy (O'Neill, 2013; O'Neill et al., 2013; O'Neill & Nicholson-Cole, 2009). Conversely, images of climate solutions (e.g., houses with solar panels/wind turbines) were found to elicit higher levels of self-efficacy[1].

Only a handful of studies have gone beyond assessing the salience and self-efficacy of climate change images to examine the role of other factors such as affective/emotional responses to images and/or the personal relevance of images (Chapman et al., 2016; Leviston, Price, & Bishop, 2014; O'Neill & Hulme, 2009). For example, in an international survey (N = 3014) Chapman et al. (2016) examined reactions to climate change images that depicted causes, impacts or solutions. In addition to measures of willingness to change behaviour and policy support, the study assessed affective response (i.e., how positive or negative the image made them feel) and issue/topic congruence (i.e., to what extent do you understand what this image is trying to convey). The study found distinct differences between the image types. Images of climate solutions generated a positive response with regard to topic congruence, but poorer attitudes (i.e., motivation to change behaviour and support for policy) compared to images depicting the impacts and causes of climate change. These latter images generated a negative topic congruence response but more supportive attitudes (Chapman et al., 2016). Leviston et al. (2014) also explored affective responses to climate change imagery through two workshops held in Perth, Australia (N = 52). Participants were first asked to sort the images into two piles according to whether they understood the images' relevance to the topic or not. For those images deemed relevant, participants were then requested to place the image on a grid based on Russell's (1980) circumplex model of emotion, which classifies emotions

[1] While this pattern of findings was replicated in a large, cross-national study (Metag, Schäfer, Füchslin, Barsuhn, & Kleinen-von Königslöw, 2016), another study by Chapman et al. (2016) found that images of climate solutions were the least engaging in terms of motivating personal behaviour change and support for government policy. Instead, they concluded that the images most likely to influence viewer engagement were of climate impacts. Overall, though, the weight of evidence suggests that the images used most frequently in the media (i.e., images of climate change impacts) are associated with increased issue salience, but not self-efficacy (Metag et al., 2016).

according to valence (i.e., positive or negative) and arousal (i.e., high/active or low/inactive). Images of climate impacts (e.g., flooding, fires, and collapsing ice shelves) were most commonly selected as being topic relevant, and were consistently ranked as being negative and having high arousal. Images of climate solutions (although not selected as relevant as frequently as the more iconic images of climate impacts) were also ranked as high arousal and, similar to the study conducted by Chapman et al. (2016), elicited positive emotions.

While this prior research is important, it has tended to focus on how people react to the images in isolation of accompanying text (DiFrancesco & Young, 2011; Hart & Feldman, 2016; Powell et al., 2015; Wozniak, Lück, & Wessler, 2015). As such, the capacity for images to influence message processing in pro-environmental contexts has been largely overlooked (Hart & Feldman, 2016). This is problematic because, as argued by DiFrancesco and Young (2011), "visuals and text should be considered together as 'co-constructors' of environmental narratives" (p. 520).

To the best of my knowledge, only one study, conducted by Hart and Feldman (2016), has investigated the interplay of images (i.e., photographs) and text in a pro-environmental context. The study manipulated both climate change imagery (i.e., images of solar panels, floods, protest/march, smoke stacks versus no image) and text (i.e., message content about climate impacts, climate change actions or both) to assess the effect of different combinations of images and text on intentions to engage in climate change-related political behaviour. The results (N = 1,575, American sample) showed that the combination of solar panel images with text that discussed actions to address climate change led to an increase in participants' willingness to take action via self-efficacy and issue salience. No other indirect effects were significant. This nascent research suggests that only some images can positively influence peoples' engagement with messages about environmental issues (Hart & Feldman, 2016).

The present thesis contributes to the extant literature in two ways. First, the research moves beyond the context of climate change communication to examine the context of sustainable urban stormwater management. Second, it extends the literature beyond looking at individuals' reactions to the image itself, to assess how the emotions elicited by images, which are embedded into written messages, then influence message processing and subsequent engagement with the issue of sustainable urban water management. This research therefore makes an important contribution to understanding the effect of images on engagement with pro-environmental communication more broadly. Before introducing the theoretical framework used to explore the effect of images on message processing and subsequent engagement (see Section 1.4), a brief introduction to the applied context of the thesis is provided.

1.3. Thesis context: Sustainable urban stormwater management

The current research seeks to extend the image-related research conducted to date in pro-environmental contexts to the context of sustainable urban stormwater management.[2] Evidence suggests storms and associated flooding are extremely costly natural disasters (Wong et al., 2013) and are likely to increase in frequency as extreme rainfall events become more common (Bureau of Meteorology & CSIRO, 2016; Climate Council Australia, 2017; Sun, Solomon, Dai, & Portman, 2007; Wasko & Sharma, 2015). Indeed, extreme weather events have the potential to create "more damage and thus adversely affect society more than long term changes in the mean climate that are attributed to anthropogenic greenhouse gas emissions" (Thompson & Otto, 2015, p. 439). Furthermore, there is growing recognition that poorly managed stormwater systems greatly contribute to poor catchment health as well as marine pollution (Wong et al., 2013). It is therefore not surprising that governments across the globe (including Australia, the geographic region relevant to this thesis) are investing substantially in sustainable urban stormwater management initiatives to address these challenges (Brown & Farrelly, 2009; Cettner, Ashley, Hedstrom, & Viklander, 2013; Fletcher et al., 2014; Morison & Brown, 2011; Wong et al., 2013). This investment represents a transition away from traditional urban water management practices, which focus on pipes and sewer systems, to more environmetally sustainable solutions such as raingardens, wetlands and permeable paving (Wong & Brown, 2008), which are designed to help reduce the impact of stormwater on urban catchments.

A review of the literature identified that the barriers to the uptake of sustainable urban stormwater management in Australia are social rather than technical in nature (Sharma, Cook, Tjandraatmadja, & Gregory, 2012). The dominant view is that sustainable urban stormwater management initiatives are technically feasible but, given that such infrastructure is provided in the public domain, implementation is inhibited by a lack of understanding and acceptance by the wider community (Colmar Brunton Social Research, 2005; James et al., 2010; Sharma et al., 2012; Wong & Brown, 2008). Therefore, there is a need to identify ways to increase community engagement with this topic (Brown & Farrelly, 2009; Sharma et al., 2012). Given that images can help bring important pro-environmental topics to peoples' attention, establishing evidence-based guidelines around images that engage (or disengage) communities with sustainable urban stormwater management could facilitate the transition to sustainable urban stormwater management (Corner, Webster, & Teriete, 2015; Nicholson-

[2] Around the globe, the term sustainable urban stormwater management is used similarly to terms such as Water Sensitive Urban Design, Low Impact Development, Integrated Urban Water Management, Sustainable Urban Drainage Systems, Best Management Practices or Stormwater Control Measures (Fletcher et al., 2014).

Cole, 2005; O'Neill, 2013). This study therefore represents a novel integration of theory to address the critical real-world issue of how better to engage communities in sustainable urban water management policy initiatives.

1.4. Theoretical framework

1.4.1. A dual processing approach to message processing

The relationship between images and engagement with messages about sustainable urban stormwater management is examined in this thesis through the lens of a dual processing model. Dual processing models, such as the elaboration likelihood model (ELM; Petty & Cacioppo, 1986) and the heuristic-systematic model (HSM; (Chaiken, 1980), dominate the literature on message processing and attitude change (Bodenhausen, Sheppard, & Kramer, 1994; Cooper & Nisbet, 2016; Dash, Meeten, & Davey, 2013; Gawronski & Creighton, 2013; Lazard & Atkinson, 2015; Petty & Cacioppo, 1986; Petty & Briñol, 2015). While the two models are conceptually similar (Dash et al., 2013; Perloff, 2010; Petty & Wegener, 1998), this thesis will focus on the more widely researched ELM (Gawronski & Creighton, 2013; Lazard & Atkinson, 2015; Perloff, 2010; Petty & Cacioppo, 1986). The reason for this is that the ELM conceptualises depth of processing as a dimension that may vary from high to low, rather than categorically distinguishing 'systematic' processing from 'heuristic' processing. Because the focus of this thesis is on examining the potential role of emotive images in influencing greater or lower depth of message processing, the ELM is most appropriate to the outlined theoretical aims.

According to the ELM, message processing (i.e., elaboration) ranges on a continuum from shallow processing (also sometimes referred to as the peripheral route/path) to deep processing (referred to as the central route/path; Petty & Wegener, 1999). Higher or deeper levels of processing requires individuals to carefully scrutinise and elaborate on the issue-relevant arguments within the message. Processing via this path has been shown to lead to increased knowledge and understanding of an issue (Bok & Min, 2013; Nabi, 2003; Petty & Wegener, 1998; Smith & Shaffer, 2000). Therefore, message content will have the strongest effect on attitude formation when the message is processed via the central path (Petty & Wegener, 1998). In addition, any changes to attitudes or behaviour that follow are likely to be more enduring and resistant to change (Petty, Brinol, & Priester, 2009; Petty & Wegener, 1998). As such, when trying to create lasting attitudinal and behavioural change, as is the goal of many pro-environmental communications, it is most desirable to have individual's process messages more deeply, through the central path (Klöckner, 2015; Meijnders, Midden, &

Wilke, 2001; Petty & Cacioppo, 1986). Due to the cognitive effort involved, only message recipients who are motivated and able to engage in effortful processing are likely to use this pathway (Petty & Cacioppo, 1986; Petty & Wegener, 1998).

Conversely, message recipients lacking the motivation or ability to engage in effortful processing have been found to rely on quick, less-effortful cues to process the message, as these require relatively lower levels of cognitive engagement (Petty & Cacioppo, 1986). This alternative, less effortful pathway has been termed the peripheral route. Research suggests that superficial 'cues', such as trust in the message source or the mere number of 'for' versus 'against' arguments, are likely to exert a strong influence on a person's judgement when central processing is low (Petty & Wegener, 1998). While this path is no less effective for attitude formation, any changes that do ensue have been shown to be less enduring, more susceptible to counter-persuasion, and less predictive of behavioural change (Petty et al., 2009; Petty & Cacioppo, 1986).

While a myriad of variables exist that can influence depth of message processing (Eagley & Chaiken, 1993; Petty & Cacioppo, 1986; Spack, Board, Crighton, Kostka, & Ivory, 2012), the ELM posits that there is a critical stage determining the depth at which a message will be processed. This determination begins at the point of initial exposure to the communication message (Lazard & Atkinson, 2015; Petty & Wegener, 1998). Both eye-tracking and brain imaging research have shown that images are the first thing that people focus on when looking at a communication message (Domke et al., 2002; Enser et al., 2005; Miller & Stoica, 2003; Yantis, 2005) and are processed faster than text (Hart & Feldman, 2016; Powell et al., 2015; Sontag, 2017). This is especially true of emotional images: viewers need 240 milliseconds to recognise a neutral picture but only 105 milliseconds for negative images and 180 milliseconds for positive images (Young, 2016). The finding that images, and especially emotive images, are processed quickly has implications for pro-environmental communications, as images used in this context are often highly emotive in nature (DiFrancesco & Young, 2011; Domke et al., 2002; Leiserowitz, 2006; O'Neill, 2013; Sleenhoff, Cuppen, & Osseweijer, 2015). Given this practice, it is important to explore the potential for the emotions elicited by such images to influence how people process the accompanying written message (Banse, 2013; Cooper & Nisbet, 2016; Damasio, 1994; Forgas, 2008; Lazard & Atkinson, 2015; Nabi, 2003; Slovic, Finucane, Peters, & MacGregor, 2004; Zajonc, 1980).

Some research has already examined the role of emotions in depth of message processing. One framework in particular, the appraisal-tendency framework of emotion (Lerner & Keltner, 2000, 2001; Smith & Ellsworth, 1985), offers important insights that

inform this thesis and the framework is therefore described below (see section 1.4.2). The next section, however, describes the broader research establishing how affect, mood and discrete emotions influence depth of processing.

1.4.2. Past research exploring the role of affect/mood on depth of processing

Before proceeding further, it is important to provide some definitional clarifications. The terms affect, mood, and emotions are often used interchangeably, although they are conceptually different (Batson, Shaw, & Oleson, 1992). In this thesis, affect is used as an all-encompassing term for any type of emotional experience generally defined as either positive or negative (Bissing-Olson, 2015; Cooper & Nisbet, 2016; Petty, Cacioppo, & Kasmer, 1998; Slovic et al., 2004). The term emotion is used to denote discrete, intense, internal reactions that result from a cognitive appraisal of a stimulus and which typically exist in relatively short time spans (Cooper & Nisbet, 2016; Fredrickson, 2001; Frijda, Kuipers, & ter Schure, 1989; Kühne & Schemer, 2015; Lazarus, 1991; Smith & Ellsworth, 1985). To illustrate, a person who develops a generalised positive feeling towards stormwater policy is exhibiting positive affect. The same person experiencing a transitory feeling of disgust at the mention of recycled sewerage water is exhibiting a discrete emotion. Emotions are also distinct from moods, which tend be lower intensity, and potentially longer-term, untargeted and diffuse feelings that do not have a definite cognitive component (Finucane, Peters, & Slovic, 2003; Nabi, 1999).

Emotions can be further categorised as either integral or incidental. Integral emotions are psychological reactions that are contextually relevant to a particular context or stimulus, whereas incidental emotions are reactions that are irrelevant (or unrelated) to a particular context/stimulus (Han, Lerner, & Keltner, 2007; Isbell, Lair, & Rovenpor, 2016; Kühne & Schemer, 2015; Nabi, 2002, 2003). By way of illustration, a typical incidental emotion manipulation used in experimental studies involves having participants recall a happy/proud/sad/fearful/disgusting memory and then asking them to read and make a judgement about an unrelated topic (e.g., Tiedens & Linton, 2001). In contrast, an integral emotion is said to have occurred when a participant experiences a particular emotion in response to the presented topic. For example, a participant may experience an emotional response of fear when reading and making a judgement about a message describing the likely impacts of climate change or the emotion of hope when reading a message about a new pro-environmental initiative that has received government support. Integral, discrete emotions, as characterised by distinct cognitive appraisals, are the focus of this thesis.

A wealth of literature has documented that *incidental* affect valence influences message processing (i.e., the extent to which a message is processed either centrally or

peripherally) in a predictable manner (Han et al., 2007; Nabi, 2003; Petty et al., 1998). For example, when personal relevance is low or "unconstrained" (i.e., when people do not know whether the information is relevant to them or not), prior inducement of negative affective states and moods lead to more central processing of messages. Conversely, positive affective states and moods lead to more peripheral processing (Hullett, 2005; Mackie & Worth, 1989; Petty & Briñol, 2015; Schwarz, Bless, & Bohner, 1991; Schwarz & Clore, 1983). Early research seeking to understand the role of affect and mood on depth of processing posited that negative affect or mood signals that there is a 'problem' requiring increased attention and, therefore, encourages more central processing. Conversely, positive affect or mood signals that 'all is well' thus leading to peripheral processing (Bodenhausen, Kramer, & Susser, 1994; Forgas, 2008; Schwarz & Bless, 1991; Schwarz & Clore, 1983; Wegener, Petty, & Smith, 1995).

More recent research, however, has questioned the core assumptions of valence based approaches. Such an approach assumes that all positive and all negative emotions are equal and lead to similar effects on message processing (Bodenhausen, Sheppard, et al., 1994; DeSteno, Petty, Wegener, & Rucker, 2000; Lerner & Keltner, 2000; Lerner, Li, Valdesolo, & Kassam, 2015; Tiedens & Linton, 2001). Research investigating the effects of distinct emotions has established that some emotions of the same valence have differential impacts on subsequent depth of processing (Bodenhausen, Sheppard, et al., 1994; Lerner & Keltner, 2000, 2001; Lerner, Small, & Loewenstein, 2004; Tiedens & Linton, 2001). This body of research, informed by the Appraisal-Tendency Framework, argues that differences in the cognitive appraisals underpinning emotions drive differences in depth of processing (Lerner & Keltner, 2000; Tiedens & Linton, 2001). In particular, proponents of the Appraisal-Tendency Framework argue that discrete emotions elicit varying levels of message processing because they differ in the cognitive appraisal dimension of *certainty*. The Appraisal-Tendency Framework and the central role of the cognitive-appraisal of certainty for depth of processing are discussed in the following section.

1.4.3. Appraisal-Tendency Framework: the role of emotions

Cognitive appraisal theories of emotion, like the Appraisal-Tendency Framework, provide insights into how discrete emotions differentially influence depth of processing by drawing attention to the cognitive dimensions underlying each emotion (Frijda et al., 1989; Lerner & Keltner, 2000, 2001; Smith & Ellsworth, 1985). These theories aim to explain why certain events and stimuli lead to specific discrete emotional responses. That is, they argue that it is the cognitive appraisal of an event, rather than the event itself, that determines which

discrete emotion will be elicited (Frijda et al., 1989; Smith & Ellsworth, 1985; Smith & Lazarus, 1993).

In their seminal research, Smith and Ellsworth (1985) identified six cognitive appraisal dimensions of discrete emotions (see Table 1.1). These are: the degree to which one feels unpleasant or pleasant in response to the stimulus (pleasantness); whether the event is thought to be controlled by the self or the situation (control); the degree to which someone feels he/she or some-one else is responsible (responsibility); whether the stimulus draws or repels the person's attention (attentional activity); the anticipated amount of effort to process/deal with the stimulus (anticipated effort); and whether the event is perceived as predictable and certain versus unpredictable and uncertain (certainty). Many other studies have found similar appraisal-patterns (see Ortony, Clore, & Collins, 1988; Roseman, 1984; Scherer, 1999; Weiner, 1980).

There is also common agreement among appraisal theorists that different combinations of cognitive appraisals give rise to different emotions (Frijda et al., 1989; Han et al., 2007; Smith & Ellsworth, 1985; Smith & Lazarus, 1993). That is, each discrete emotion is identified or defined by its distinct profile with respect to appraisal dimensions. To illustrate, the discrete emotion of disgust is typically elicited when a situation or event is perceived to be unpleasant and is perceived with a high degree of certainty, a strong desire to repel, a moderate degree of anticipated effort, a moderate sense of human control, and with the notion that some-one else is responsible (Smith & Ellsworth, 1985). In contrast, the emotion of sadness, which shares many of the same cognitive appraisals as disgust, tends to be elicited when an event is perceived to have a high degree of uncertainty and is perceived to be controlled by the situation rather than the self (Smith & Ellsworth, 1985); see Table 1.1.

Table 1.1. Illustration of the Appraisal-Tendency Framework

Cognitive appraisal dimension	**Disgust**	**Sadness**	**Boredom**	**Happiness**	**Hope**
Certainty	Certain	Uncertain	Certain	Certain	Uncertain
Pleasantness	Unpleasant	Unpleasant	Unpleasant	Pleasant	Pleasant
Attentional activity	Low	Low	Low	High	High
Anticipated effort	High	High	Low	Low	Low
Control	Human	Situational	Situational	Human	Situational
Responsibility	Other	Other	Other	Self	Self

Note. Table adapted from Smith and Ellsworth (1985)

Beyond describing emotional reactions, however, research has shown that these underlying cognitive dimensions are useful for making predictions about how people respond when experiencing different discrete emotions (Han et al., 2007; Lerner & Keltner, 2000, 2001). Put another way, the Appraisal-Tendency Framework predicts that each discrete emotion carries with it motivational properties (called action tendencies) that, among other things, can inform subsequent message processing, be it depth of processing, judgements, or decisions (Han et al., 2007; Iyer, Webster, Hornsey, & Vanman, 2014; Lerner & Keltner, 2000). Of particular relevance to this thesis, is evidence suggesting emotions that differ with regard to the appraisal dimension of *certainty* have differential effects on depth of processing (Lu & Huang, 2017; Tiedens & Linton, 2001). For example, within the Appraisal-Tendency Framework (Lerner & Keltner, 2000, 2001), disgust is proposed to be characterised by high levels of certainty (Smith & Ellsworth, 1985) and therefore to promote more peripheral processing (Lerner & Tiedens, 2006). Conversely, sadness is characterised by low levels of certainty (Smith & Ellsworth, 1985) and is associated with more central processing (Bodenhausen, Sheppard, et al., 1994; Lerner & Tiedens, 2006; Lu & Huang, 2017).

Essentially, the Appraisal-Tendency Framework posits that the cognitive appraisal of certainty makes people feel confident in outcomes of subsequent situations and/or decisions, which in turn, lowers an individual's motivation to engage in central processing (Small & Lerner, 2008; Tiedens & Linton, 2001). Conversely, uncertainty gives people the sense that they should carefully examine the content before making a decision and is therefore likely to motivate more central processing (Small & Lerner, 2008; Tiedens & Linton, 2001). Empirical

support for this contention has been provided by Tiedens and Linton (2001) in their research testing the effect of a range of discrete incidental emotions on depth of processing. Across a series of studies, they found that participants who experienced emotions that are associated with a high degree of certainty (e.g., anger, contentment, disgust) were more likely to engage in peripheral processing than participants who experienced emotions associated with a low degree certainty (e.g., fear, hope). Similarly, in an earlier study conducted by Bodenhausen, Sheppard, et al. (1994), people experiencing anger (high certainty) were more likely to use peripheral processing than people induced to feel sadness (low certainty). In one of only a handful of studies that have focused on an integral emotion, Meijnders et al. (2001) demonstrated that fear (low certainty), elicited by watching a short video of climate change impacts, led to more central processing of a related accompanying written message, which in turn led to more favourable attitudes towards energy conservation.

In sum, the Appraisal-Tendency Framework states that different emotions are associated with different levels of certainty appraisals, which influence depth of message processing. Despite this pioneering research, we are far from having a complete picture of the effects of discrete emotions on depth of processing and, ultimately, engagement with the issue being communicated (Isbell et al., 2016; Loewenstein & Lerner, 2003; Nabi, 1999). With a couple of exceptions (see Meijnders et al., 2001; Nabi, 1998, 2002), prior research has focused on incidental emotions (Han et al., 2007; Isbell et al., 2016; Mosier & Fischer, 2010). However, there is little that one can do to change incidental emotions within a pro-environmental communication campaign, as they happen prior to people receiving the stimulus. Conversely, integral emotions, which are elicited in response to a target stimulus, afford communicators greater scope to shape what emotions are elicited. As such, it is important to understand whether the findings in relation to incidental emotions generalise to integral emotions (Isbell et al., 2016; Nabi, 1999). As argued by Nabi (1999, p. 293), "discrete, message-relevant negative emotions may direct information processing and subsequent attitude change and information recall, particularly when the emotion aroused is substantively linked to a message's focal topic".

The need for integral emotion research is also supported by a meta-analysis examining the effects of emotions on judgement and decision-making. The meta-analysis identified only two studies that assessed the effect of emotions on depth of processing, no studies using images as part of the emotional manipulation (although a large number used film clips), and no studies using an integral emotion manipulation (Angie, Connelly, Waples, & Kligyte, 2011). Thus, this thesis, which focuses on the emotions elicited by images relevant to the

communication message, extends current understanding of the role of images and emotions on message processing.

1.4.4. The moderating role of personal relevance on depth of processing

As stated by Petty and Wegener (1998, p. 6), "the most important variable influencing a person's motivation to think is the perceived personal relevance or importance of the communication". Personal relevance (sometimes referred to as issue involvement, self-relevance or importance), is the extent to which the topic is related to the self; it is an indicator of how much the individual considers the topic to be important (Petty & Cacioppo, 1990). The moderating role of personal relevance on depth of processing is supported by a large body of research, including a meta-analytic review (Johnson & Eagley, 1989). According to the ELM, when messages are perceived as personally relevant, recipients are more likely to engage in central processing of message content, which will, in turn, inform subsequent attitudes and behaviours (Petty & Wegener, 1998). However, if the topic (or message) is not personally relevant or they feel unsure of its personal relevance, other more extraneous cues (e.g., message source and emotions) influence message processing through more peripheral or heuristic processes (Petty et al., 2009; Petty, Cacioppo, & Schumann, 1983; Petty & Wegener, 1998). At low levels of personal relevance (or when the personal relevance of a message is unknown), affect can serve as a peripheral cue to guide/influence information processing, such that positive affect limits depth of processing and negative affect enhances depth of processing (Damasio, 1994; Meng-Chen & Chao-Chan, 2015; Petty et al., 2009; Petty & Cacioppo, 1986; Petty & Briñol, 2015; Schwarz & Clore, 1983; Slovic et al., 2004; van de Velde, Verbeke, Popp, & van Huylenbroeck, 2010).

Although recent research has moved past a valence-based approach to understanding the effect of emotions on depth of processing, no studies could be identified that assessed personal relevance as a moderator to the effect of discrete emotions on depth of processing. However, some research conducted within the pro-environmental context has shown that framing effects are only effective for participants with very low levels of pre-existing involvement in environmental issues (Schultz, Dean, Newton, Ross, & Fielding, 2017; van de Velde et al., 2010). For example, a study looking at the influence of different message frames (i.e., liveability, sustainability, resiliency or productivity) to promote sustainable urban water management initiatives found all four message frames were equally successful for individuals that identified as highly involved in environmental issues, but not among those with low levels of involvement in pro-environmental issues (Schultz et al., 2017). Drawing on this finding, the experimental studies included in this thesis assessed personal relevance as a moderator of the impact of images on depth of message processing. In the context of this

thesis, personal relevance was operationalised using a measure of strength of environmental identity. That is, it is argued that individuals with a stronger environmental identity will be more likely to perceive the pro-environmental messages used in this thesis as being personally relevant. Therefore, they will have an inherent motivation to process the message (i.e., factsheet) content deeply and will be less susceptible to the influence of emotions acting as peripheral cues.

1.5. Depth of processing mediates overall engagement with the message

As noted in Section 1.1, in this thesis engagement is defined as the extent to which a person knows what the issue is (cognitive engagement), has positive or supportive attitudes towards an issue or policy (affective engagement), and is motivated to take action (behavioural engagement). Past research has shown that a high level of message processing is associated with improved recall of message arguments (Bok & Min, 2013; Nabi, 2003; Smith & Shaffer, 2000), higher levels of attitudinal support (Meijnders et al., 2001; Nabi, 1999, 2002), and is a stronger predictor of behaviour and/or behavioural intentions (Petty & Cacioppo, 1986). These findings map onto the key areas of interest: cognitive, affective, and behavioural engagement respectively. This research will therefore assess the role of depth of processing as a mediator of the impact of integral emotions on affective, cognitive and behavioural message engagement.

1.6. Research questions

In summary, research on the capacity of images to enhance or diminish message engagement with pro-environmental communication has been neglected (Lazard & Atkinson, 2015; Rodríguez Estrada & Davis, 2015; Trumbo, 1999). Prior research suggests recipients of a communication message will invariably have their attention drawn first and foremost to images included in the message (Domke et al., 2002; Enser et al., 2005; Miller & Stoica, 2003; Yantis, 2005). Both the ELM and the Appraisal Tendency Framework suggest that the way in which individuals emotionally react to an image can have a flow on effect to their depth of message processing (Lerner & Keltner, 2000; Petty & Wegener, 1998), which in turn, can influence their overall engagement with the message (Bok & Min, 2013; Nabi, 2003; Smith & Shaffer, 2000).

Whilst past research has focused on the influence of unrelated affect valence on message processing, it is not clear whether these findings will generalise to the effects of discrete, message-relevant emotions (Isbell et al., 2016; Lerner et al., 2015; Loewenstein & Lerner, 2003; Perrott & Bodenhausen, 2002). Isbell et al. (2016) suggests that the lack of past research on integral emotions is linked to methodological challenges in manipulating integral

emotion without varying the content of the information that the person processes, as this procedure would introduce confounding variables. This problem can, however, be overcome by using images to manipulate discrete, integral emotions. That is, embedding related images allows for the manipulation of integral emotions while leaving the content of the message identical across conditions. Therefore, this thesis extends past ELM and Appraisal-Tendency Framework research to include tests of the effects of integral emotions (rather than the more widely assessed incidental emotions) and overcomes previously identified methodological issues by using related images as the precursor to the emotion felt by the message recipient.

To the best my knowledge, only one published study has explored the effect of the emotions elicited by related imagery on depth of processing of the accompanying message (Meijnders et al., 2001). However, the research used videos as the visual format rather than images, despite the ubiquity of still images in mass media and communications. This thesis is therefore designed to fill the identified research gap by offering a moderated mediation model of message processing (see Figure 1.1 below). That is, the thesis will explore how different discrete emotions, elicited by a related and embedded image, influence participants' depth of processing of an accompanying message and overall engagement with the topic of sustainable urban stormwater management. The thesis will assess the role of personal relevance as a key moderator of these effects. Finally, comparatively little research to date has explored the effects of either integral or incidental discrete positive emotions on depth of processing. The present program of research will therefore also examine a discrete positive emotion (serenity), thus extending the literature in this area.

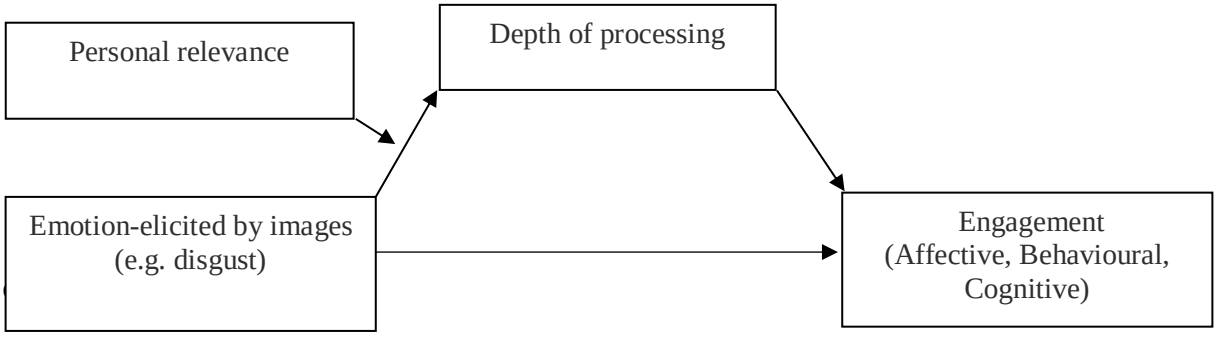

Figure 1.1. Conceptual diagram of the moderated mediation between the discrete emotions elicited by images on message engagement through depth of processing

An important first step in undertaking this program of research was to identify the type of images commonly used in the focal context of sustainable urban stormwater management. Research was also undertaken to examine whether community members perceived these

images as being relevant to the focal topic and/or themselves. Given the focus of the thesis on emotions, the types of emotions elicited by these commonly used images was also examined. Thus, the initial research questions were as follows:

Research Question 1a: What types of images are commonly used in communications about sustainable urban stormwater management?

Research Question 1b: What types of emotions are elicited by the images used in sustainable urban stormwater management contexts? What types of images are considered both relevant to the focal topic and personally relevant?

Research Question 1c: To what degree are community members' responses to sustainable urban stormwater management images consistent in terms of emotion elicited, personal relevance, and topic congruence?

While this initial research study can provide important insights about what types of images are currently being used and how people respond to these images, it cannot establish the causal effect of the emotion elicited by images on depth of processing and overall message engagement. Therefore, a series of experimental studies were also conducted to establish, under controlled conditions, the causal effect of three different discrete emotions (disgust, sadness, serenity) elicited by images on depth of processing. The selection of these emotions was based on the results from Study 1, which identified that disgust, sadness, and serenity were the dominant emotions elicited by images commonly used in communications about sustainable urban stormwater management.

In all studies, the emotion elicited by the image—which was embedded within a factsheet about sustainable stormwater management—was manipulated in order to understand the causal effect of the images on message processing and engagement. Importantly, the Appraisal-Tendency Framework suggests that the manipulated emotions will differentially influence depth of processing. That is, both disgust and serenity, which are associated with the cognitive appraisal of certainty, are predicted to decrease depth of processing. Sadness, on the other hand, which is associated with the cognitive appraisal of uncertainty, is predicted to increase depth of processing. In all four experimental studies, the effect of the images on depth of processing was compared to a control condition, whereby participants were only given the written content of the message with no embedded image.

Beyond emotions, past research also suggests that the most influential factor motivating depth of processing is the degree to which the communicated issue is personally relevant to the message recipient (Petty & Wegener, 1998). According to the ELM, messages perceived to be personally relevant will be processed through the central route (Petty, Cacioppo, & Schumann, 1983; Petty & Wegener, 1998). Therefore, this thesis assesses the moderating role of the personal relevance of pro-environmental issues—as measured by the strength of an individual's identification with pro-environmental issues—on depth of processing. Specifically, it is argued that individuals with a stronger environmental identity will be more likely to perceive a pro-environmental message as being personally relevant and therefore have higher motivation to deeply process the message (i.e., factsheet) content. As such, any emotion elicited by the image manipulation is less likely to influence their depth of processing (Roh, Rickard, McComas, & Decker, 2018; Schultz, Dean, Newton, Ross, & Fielding, 2017). Therefore, the following research question and hypotheses were proposed and tested in Studies 2-5:

Research Question 2: Do discrete integral emotions elicited by images embedded into a related written communication about sustainable urban stormwater management have an effect on depth of processing and does the perceived personal relevance of the communication message moderate the effect?

Hypothesis 1: Embedded and related images that elicit the emotions of disgust will lead to lower engagement with an accompanying factsheet relative to an embedded image that elicits sadness and to a control condition that includes a factsheet with no embedded image (Studies 2 and 3).

Hypothesis 2: Embedded and related images that elicit the emotions of serenity will lead to lower engagement with an accompanying factsheet relative to an embedded image that elicits sadness and to a control condition that includes a factsheet with no embedded image (Studies 4 and 5).

Hypothesis 3: Images that elicit sadness will lead to higher levels of depth of processing in comparison to the control condition that include no image (Studies 2-5).

Hypothesis 4: The effect of the images on depth of processing will be attenuated for participants with a stronger environmental identity (Studies 2 and 3).

Finally, the research program presented in this thesis will assess depth of processing as a mediator of overall engagement with the focal topic, stormwater management. The research tests the indirect effect of depth of processing, as a function of the different image conditions, on cognitive, affective and behavioural engagement with messages about sustainable urban stormwater management initiatives. Specifically, the following research question and hypothesis was proposed.

Research Question 3: Does depth of processing mediate the effect of a discrete emotion elicited by an image on overall engagement with the message topic/content?

Hypothesis 5: Depth of processing will fully mediate the effects of the images on recipients' cognitive engagement (i.e., message recall), affective engagement (i.e., attitude towards policy support) and behavioural engagement (i.e., intentions to discuss message contents with others; Studies 2-5).

1.7. Methods and thesis overview

Different research methods are applicable to different objectives of this program of research. Accordingly, a multi-method approach was adopted that included Q-methodology (which has both quantitative and qualitative components) as well as experimental research. In response to Research Question 1(a-c), Study 1 used an image-sort Q-method technique that has been used in past research investigating which images engage people with pro-environmental issues (O'Neill et al., 2013; Sleenhoff et al., 2015; Swaffield & Fairweather, 1996). A key strength of Q-methodology is that it allows for the study of complex issues from the participant's point of view and is therefore well suited to examine peoples' subjective reactions to visual stimuli according to a pre-defined set of instructions (e.g., "Please indicate the extent to which this picture is of something relevant to stormwater in cities and towns"). Furthermore, Q-method clusters peoples' reactions (Van Excel & de Graaf, 2005), which aligns with Research Question 1c of understanding the degree to which community members' responses aligned or diverged. The results of Study 1 are described in Chapter 2.

Importantly, Study 1 gave important insights into the most common discrete emotions elicited by the images and, therefore, informed the development of the experimental research designed to answer Research Questions 2-4. In order to test the proposed moderated mediation model (see Figure 1.1), a series of experimental studies were conducted. Chapter 3 presents the results of two studies that explored the role of integral disgust (Study 2) and

integral disgust versus sadness (Study 3) on depth of processing and overall message engagement.

In Chapter 4, the results of two studies exploring the role of integral serenity across two different contexts are described (Studies 4 and 5). For Study 4, the context of the study was the types, causes, and effects of stormwater pollution, while for Study 5 it was plastic rubbish in oceans. Across both Study 4 and Study 5, images that predominately elicited integral serenity were compared to an image that predominately elicited sadness or a control condition that included the message but no embedded image. In Chapter 5, the empirical findings are synthesised and the theoretical and practical implications as well as limitations are discussed.

CHAPTER 2

2. Overview

In response to Research Questions 1a, 1b and 1c, Study 1 explored community members' responses to categories of images relevant to sustainable urban stormwater management, across three key factors that can influence image engagement: emotional response, personal relevance, and topic congruence. The study also assessed the degree to which participants' responses were consistent. This chapter presents a paper that has been published in the journal *Science Communication* and has been included in its original format (Schultz, Fielding, & Newton, 2018). The content may be read as a stand-alone chapter and, as such, it contains material that repeats some of the theoretical framework outlined in the introductory chapter. Furthermore, the format and American spelling in this chapter align with the requirements of the journal where the material was published.

Schultz, T., Fielding, K., & Newton, F. (2018). Images that engage people with sustainable urban stormwater management. *Sci Comm, 40*(2), 199-227.
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2.1. Abstract

This study explored responses to categories of images relevant to an environmental management issue—stormwater management—across three dimensions that influence engagement: emotional response, personal relevance, and topic congruence. Although images of oceans elicited positive emotions, most participants did not perceive such images as relevant to the topic. Images of traditional stormwater infrastructure evoked negative emotions and were perceived as topic congruent but not personally relevant. Images of flooding were ranked highly across all three dimensions. These findings have implications for the development of communication materials that appeal to the broader public.

2.2. Introduction

Images can be a powerful mechanism for engaging people with complex topics (Nicholson-Cole, 2005; O'Neill, 2013; Smith & Joffe, 2013). Furthermore, the use of images is predicted to increase in importance with the growth of new media (i.e., websites and social media), which are heavily image focused (Anderson, 2015; Lazard & Atkinson, 2015). Yet in the fields of science and pro-environmental communication, images are often treated as an add-on element with little attention given to how people process or decode them (Hansen & Machin, 2014; Lazard & Atkinson, 2015). This oversight has drawn attention to the need to identify the characteristics or dimensions of images that influence engagement (Anderson, 2015; O'Neill, 2013; O'Neill & Hulme, 2009; O'Neill & Nicholson-Cole, 2009; Smith & Joffe, 2013).

The current study explores these issues in the context of sustainable urban water management (SUWM; Wong & Brown, 2009). The transition away from traditional stormwater management practices is being driven by a range of concerns, including the impact of increasing extreme rainfall events associated with anthropocentric climate change (Christidis, Stott, Karoly, & Ciavarella, 2013; Sun et al., 2007) and the impact of polluted stormwater on catchments (Walsh, Fletcher, & Ladson, 2005). In Australia, the delivery of SUWM to the wider Australian community has been hampered by poor communication and limited community engagement (Brown & Farrelly, 2009). Given the important socio-environmental implications, there is a need to identify ways to increase community engagement with this topic (Brown & Farrelly, 2009). Establishing evidence-based guidelines around which types of images best engage communication message recipients (Corner et al., 2015; Nicholson-Cole, 2005; O'Neill, 2013) offers a pathway forward for practitioners. Accordingly, the current study focuses on different categories of SUWM images and how engagement with these images varies. Although the term engagement can be defined in

different ways (Bauer & Jensen, 2011; Deiuliis et al., 2011), we define it as a "personal state of connection with the issue…concurrently comprising cognitive, affective and behavioural aspects" (Lorenzoni et al., 2007) p. 446). This definition has been used in previous pro-environmental engagement research (Lorenzoni et al., 2007; O'Neill & Nicholson-Cole, 2009) (Lorenzoni et al., 2007; O'Neill & Nicholson-Cole, 2009), including SUWM engagement (Dean et al., 2016).

To date, however, pro-environmental image research has typically focused on the context of climate change. Furthermore, the main body of research has largely looked at only two dimensions of how images can influence engagement: issue salience (i.e., whether the image makes people feel like climate change is important) and self-efficacy (i.e., the extent to which an image makes people feel like they can do something about climate change). For example, O'Neill and colleagues (O'Neill, 2013; O'Neill et al., 2013; O'Neill & Nicholson-Cole, 2009) established that although familiar images of climate impacts (e.g., a polar bear on melting ice) engender high salience, they are also linked to decreased feelings of self-efficacy. Conversely, images of climate solutions (e.g., houses with solar panels and wind turbines) were found to elicit higher levels of self-efficacy (Hart & Feldman, 2016; O'Neill et al., 2013; O'Neill & Nicholson-Cole, 2009). Although this pattern of findings was replicated in a large, cross-national study (Metag et al., 2016), Chapman et al. (2016) found that images of climate solutions were the least engaging in terms of motivating personal behavior change and support for government policy. Instead, they concluded that the images most likely to influence viewer engagement were of climate impacts. Overall, though, the weight of evidence suggests that the images used most frequently in the media (i.e., images of climate change impacts) are associated with increased issue salience but not self-efficacy (Metag et al., 2016).

Importantly, some studies have gone beyond assessing the salience and self-efficacy of climate change images to examine the role of other dimensions such as personal relevance and affective/emotional responses to images or imagery (Chapman et al., 2016; Leviston et al., 2014; O'Neill & Hulme, 2009). Building on this research, as well as other studies from psychology and communication literature (described below), we explore three important ways that environmental images can influence engagement. Specifically, we argue that people exposed to an image are more likely to feel a sense of engagement with the issue being communicated when the image (a) evokes an emotional response, (b) is perceived to have personal relevance, and (c) is perceived as congruent with the topic being communicated. We examine these influences in the context of images commonly used in the hitherto unexplored topic of SUWM. In the following section, we discuss the relevant literature that establishes

the relationship between each of the three proposed dimensions and engagement (i.e., cognitive, affective and/or behavioural engagement).

2.2.1. Emotional response

Given that images are effective at eliciting emotional responses (Domke et al., 2002; Jarreau, Altinay, & Reynolds, 2017) and are the first thing people focus on when looking at communication materials (Enser et al., 2005), it is feasible that the emotions elicited by an image could influence how emotionally engaged the viewer is with the overall message. Indeed, it is well established in social psychology that emotions serve a primary role in the construction of attitudes (Neuman, Marcus, Crigler, & Mackuen, 2007; Zajonc, 1984). Essentially, an image can influence affective engagement with a communication message before it is even cognitively processed (Jarreau et al., 2017). For instance, empirical research has established that people are capable of processing visual stimuli so quickly that processing can occur at subliminal levels and still influence subsequent attitudinal judgments (Bornstein, Leone, & Galley, 1987).

Empirical research also suggests that emotional responses to imagery can influence cognitive engagement with pro-environmental policy and science (Cass & Walker, 2009; Meijnders et al., 2001; Sleenhoff et al., 2015). Meijnders et al. (2001), for example, used the elaboration likelihood model of persuasion (Petty & Cacioppo, 1986) to explore the effect of a negative emotion (fear) elicited by watching a short video of climate change impacts on support for the use of energy-efficient lightbulbs. Their results demonstrated that increased fear led to more in-depth processing of the accompanying written message, and this led to a more favorable attitude toward the use of energy-efficient lightbulbs (Meijnders et al., 2001). This is perhaps why using emotion-eliciting images to engage people with a topic is a common communication tactic. For example, Greenpeace, arguably the world's most influential environmental organization (Doyle, 2007), has successfully used highly emotive images of activists confronting looming whaling boats to galvanize public support for international whaling treaties (Mathiesen, 2015, June 11).

Taken together, the aforementioned body of research emphasizes the importance of considering the emotions elicited by images as a key determiner of engagement with pro-environmental issues. Subsequently, this study seeks to explore the ability of different image categories commonly used in communications about SUWM to consistently elicit a positive, or otherwise, emotional response.

2.2.2. Perceived topic congruence

Research suggests that the perceived ease with which a person processes information influences their motivation and ability to cognitively engage with a message (Frey & Eagly, 1993; Smith & Shaffer, 2000; Winkielman, Schwarz, Fazendeiro, & Reber, 2003). Given that images have strong mental imagery-evoking capabilities (Childers & Houston, 1984), an image that accurately matches the viewer's mental imagery of a particular topic may have a facilitative effect on processing fluency and, therefore, cognitive engagement. That is, when an image primes matching or congruent information stored in memory, it creates a feeling of fluency that leads to increased cognitive engagement (Smith & Shaffer, 2000). Conversely, incongruent images are likely to undermine cognitive engagement because they prime thoughts irrelevant to the message content. In other words, non-congruent images become a distraction and undermine the person's motivation and ability to engage with the message content (Frey & Eagly, 1993; Smith & Shaffer, 2000). For example, a study assessing the effectiveness of images used in slideware presentations found that slides with incongruent images (i.e., images that were not perceived as relevant to the target information) resulted in lower recall of the presentation content when compared with slides with congruent images or slides with no images (Tangen et al., 2011). Similarly, Corner et al. (2015) found that climate imagery perceived by individuals to be congruent to the topic (e.g., polar bears, smokestacks, and deforestation) were rated more highly in terms of their capacity to motivate behavioral change and support for policy. It is important to recognize, however, that further qualitative research conducted in this area by both Chapman et al. (2016) and Leviston et al. (2014) identified that a backlash effect can occur when a highly congruent image becomes "iconic" and is perceived to be "clichéd." That is, iconic images can have a negative effect on engagement "precisely because of their familiarity and over-use" (Chapman et al., 2016) p. 175).

Overall, however, there is support for the notion that the perceived congruence between an image and the topic being communicated can influence cognitive engagement. Furthermore, when communicating complex and not easily visualized topics, such as SUWM, the potential for message recipients to not perceive the imagery used as being congruent to the target topic is high. It is therefore important that practitioners gain an understanding about which categories of images can positively or negatively affect processing fluency and, therefore, cognitive engagement with the underlying message. Accordingly, this study assesses the degree to which community members felt images were relevant to the topic (i.e., perceived topic congruence).

2.2.3. Perceived personal relevance

According to the elaboration likelihood model of persuasion, "the most important variable influencing a person's motivation to think is the perceived personal relevance or importance of the communication" (Petty & Wegener, 1998, p. 6). This being the case, it seems reasonable to argue that people perceiving an image to be personally relevant will have increased motivation to engage with the overall message content (Leviston, 2013; Vries, Terwel, & Ellemers, 2014). Support for this contention comes from research conducted by O'Neill and Hulme (2009) in the context of climate change. These authors found that the most engaging images were those that the participants felt they could personally relate to. Interestingly, the more iconic images used in the context of climate change communication (e.g., polar bears and smoke stakes) have been criticized for lacking personal relevance, which is seen as counterproductive to "meaningful engagement" (Manzo, 2010; O'Neill & Nicholson-Cole, 2009).

Beyond the climate change context, the importance of perceived personal relevance was established by Manning et al. (2013) in their evaluation of the communication materials used for a local government water conservation initiative (i.e., the Townsville City Council Dry Tropics Water Smart program). Specifically, they found that individuals who did not personally relate to the images included in the posters were less likely to act upon the message (i.e., exhibit behavioral engagement; Manning et al., 2013).

Taken together, these findings suggest that the degree to which a viewer perceives an image as being personally relevant can influence his or her level of cognitive and/or behavioral engagement. What remains unclear, however, is whether perceived personal relevance differs across different categories of images and how consistent community members' responses are. Therefore, this study assesses the degree to which community members perceived images commonly used in communications about SUWM as being personally relevant.

2.2.4. The Present Study

As noted previously, past research has focused on two main dimensions of environmentally related images: issue salience and self-efficacy. The current research contributes to this literature by investigating three additional ways in which images can influence engagement—namely, emotional response, topic congruence, and personal relevance.

We also explore the degree to which community members' reactions converge and diverge. That is, we seek to examine whether different categories of images elicit the same

degree of emotion for all community members, whether all community members perceive certain categories of images as congruent to the topic, and whether certain images are personally relevant to all participants. Knowing how people react to different types of images, and whether their reactions are the same or different, is of practical importance to practitioners seeking to improve the way in which they communicate with their constituents. Although there is increasing recognition of the importance of images for connecting people to critical environmental issues (Hansen & Machin, 2014; Lazard & Atkinson, 2015), no research, to the best of our knowledge, has examined community members' reactions to categories of water-related images broadly or with specific reference to SUWM. The categories of images used in this study and reported on below include traditional stormwater infrastructure (i.e., drains and outlets), stormwater management innovations (i.e., artificial wetlands and raingardens), flood events, and oceanic environments. Due to space limitations, not all categories of images used in the study are reported on below. The included image categories were selected because they encapsulated the types of images most commonly used to communicate about SUWM.

The insights gained from this study have the potential to inform the way in which images are selected for future SUWM campaigns and represents a novel integration of theory to address the critical real-world issue of using images to engage people with an important pro-environmental initiative.

2.3. Method

The study draws on an image-sorting Q-method technique that has been used by past research investigating which images engage people with pro-environmental issues—for example, climate change (O'Neill, 2013; Sleenhoff et al., 2015; Swaffield & Fairweather, 1996) and windfarms (Beckham Hooff, Botetzagias, & Kizos, 2017). Q-methodology allows for the study of complex issues from the subject's point of view and is therefore well suited to examine peoples' subjective reactions to visual stimuli.

The key strength of Q-methodology is that it clusters peoples' reactions to different types of stimuli (van de Velde et al., 2010), which aligns with our goal of identifying whether community members will react the same or differently to images. Q-methodology elicits peoples' reactions through a process of one-on-one interviews (called Q-sorts) whereby participants sort and rank items in response to a guiding question or statement, thus producing quantitative data. The ability to quantifiably identify distinct patterns of responses among subsets of participants is not easily achieved using focus groups or surveys (Donner, 2001). Furthermore, given that participants verbalize their decision-making processes during the Q-sort, the methodology combines the benefits of having a standardized procedure that produces

quantitative data with the benefits of qualitative research (Donner, 2001; Sleenhoff et al., 2015). The qualitative data are used to understand participants' rationale for their sorting process (O'Neill & Hulme, 2009). A further strength of Q-methodology is that, in comparison to focus groups or surveys, a large number of stimuli can be assessed by a small number of participants (Brown, 1980). In this case, 23 participants were asked to perform three Q-sorts of 70 images in total.

The images selected for use were identified through an audit of communication materials targeting the wider public with information about SUWM. The audit collected 460 images drawn from websites, newsletters, online fact sheets, social media pages of government agencies and community groups involved in SUWM policy and practice. Where publication dates were provided, the search was limited to communications from within the preceding 12 months to ensure that the most up-to-date content was being considered (May 2014 to May 2015).

Consistent with past Q-methodology research (Sleenhoff et al., 2015), two researchers (including the first author) independently selected a sample of 80 images that were considered to be broadly representative of the overall collection. Images selected by both researchers were automatically included in the final set (n = 40). Images not selected by either of the researchers were discarded. Images selected by one researcher but not both were then subject to a separate audit undertaken by a third researcher (the second author), maintaining the goal of achieving a final sample of representative images. At the conclusion of this process, 70 images were selected[3]. The size of the final pool of images aligns with Watts and Stenner (2005) recommendation that 40 to 80 items are needed to maximize the stability and reliability of a Q-sort factor analysis. The images were printed in color on 6 cm × 9 cm photo paper.

Q-methodology does not require a large sample of participants (Brown, 1980). Indeed, the sample size should not total more than one third of the number of Q-sort items (Webler, Danielson, & Tuler, 2009). Given the sample of 70 images, 23 participants were therefore recruited by an external social research company from across Brisbane, Australia, and paid $70.00 each for their participation. Participants' ages ranged from 19 to 66 years (M = 43.30, SD = 16.00; see Table 2.1 for further socio-demographics).

[3] The results of a pretest study (N = 12) confirmed, with the exception of one image, the visual quality of the printed images. Furthermore, approval to use the 70 images selected for the study was sought from the source organizations. Three images were unable to be used due to copyright restrictions. The blurry and proprietary images were replaced with matched alternatives in consultation with the third selector. A complete list of all 70 images used in the study can be provided by contacting the first author.

Table 2.1. Individual characteristics of study participants

Characteristic	Total (%)
Gender	
Male	11 (47.83)
Female	12 (52.17)
Age(yrs)	
Under 35	9 (39.13)
35 to 50	6 (26.09)
Over 50	8 (34.78)
Highest education level	
School/Technical College	10 (43.48)
University	13 (56.52)
Domestic dwelling type	
House - large garden	3 (13.04)
House - medium garden	8 (34.78)
House - small garden	2 (8.70)
Apartment/townhouse - small garden	8 (34.78)
Apartment/townhouse - no garden	2 (8.70)

Given Q-method studies require a diverse range of viewpoints on the focal issue (O'Neill, 2013; ten Klooster, Visser, & de Jong, 2008; Webler et al., 2009), a short survey was also administered in order to assess the diversity of participants' knowledge, attitudes, and behaviors with regard to water. The survey items were drawn from a national study of water literacy undertaken in Australia (Dean et al., 2016). Although participants' attitudes were somewhat similar, their knowledge and behavior toward water varied. For example, participants differed in the extent to which they used their local waterways for recreational purposes, and less than 50% understood that (in Australia) stormwater is not treated before it enters waterways.[4]

The one-on-one interviews were undertaken in public libraries located across Brisbane, Australia, and took, on average, 70 minutes to complete (range 30-105 minutes). Participants were given a randomized set of the 70 images and asked to sort them onto an A0-poster with a normally distributed sorting grid (see Figure 2.1). Participants undertook three Q-sorts requiring them to sort and rank the images by each of the three dimensions in turn (the order was counterbalanced to control for potential order effects). Specifically, the images were sorted and ranked by the degree to which they were consistent with each of the following statements: (a) "This picture makes me feel positive. It brings to mind good feelings" (emotional reaction); (b) "This picture is of something relevant to stormwater in

[4] A more detailed breakdown of participant responses to these questions can be provided by contacting the first author.

cities and towns" (perceived topic congruence); and (c) "This picture is of something relevant to me. I can personally relate to this picture" (perceived personal relevance). The degree to which an image was consistent with each statement was ranked from "least" (−6) to "most" (+6). Participants were also asked to verbalize their decision-making process during each Q-sort, and approximately 27 hours of audio data were collected and transcribed.

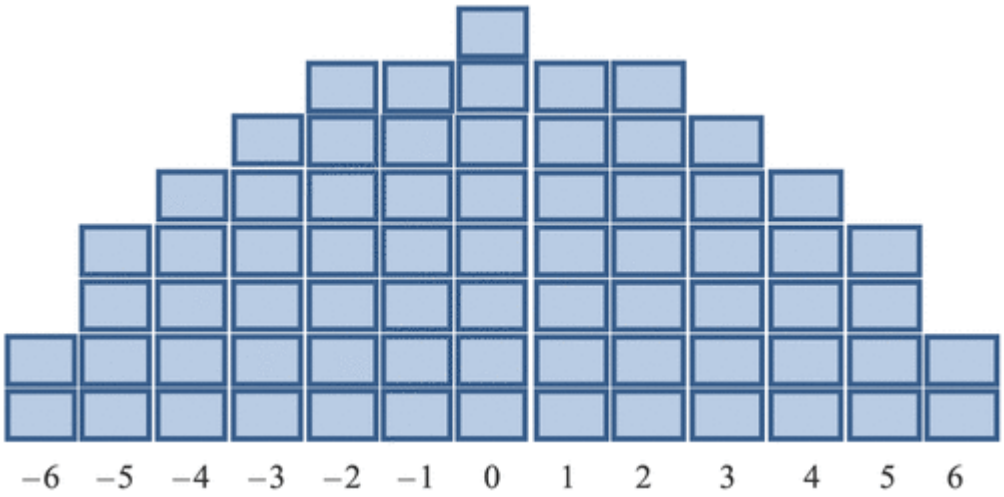

Figure 2.1. The normal distribution layout of the Q-sort board used in the current study. The scale spans low consistency (−6) through to high consistency (6)

2.4. Results

In the first section, the results of the inverted factor analysis of the Q-sort data are presented to identify the subgroups of participants for each dimension. Each subgroup comprises participants who reacted similarly to the images in terms of those that elicited positive emotions, were perceived to be highly congruent with the topic of stormwater management, or were perceived to be highly personally relevant. In the second section, we describe the pattern of responses across the different image categories and identify areas where the subgroups' reactions to the images converged or diverged.

2.4.1. Identification of the subgroups for each dimension

Data collected from Q studies are analysed using inverted factor analysis (Donner, 2001). Inverted factor analysis is the statistical basis of Q-method (van der Werff, Steg, & Keizer, 2014) and the data collected via Q-methodology is not suitable for normal factor analysis (ten Klooster et al., 2008; Watts & Stenner, 2005). For this study, we used the PQ Method computer software program to run the analyses (Schmolck, 2014). As is common with Q studies, centroid factor analysis was used for factor extraction and factors were rotated using varimax rotation (McKeown & Thomas, 2013). A separate inverted factor analysis was undertaken for each focal dimension (i.e., emotional response, perceived topic congruence, and perceived personal relevance). The analysis is considered "inverted" because it looks for

patterns among participants rather than variables, thus allowing for the identification of distinct subgroups of people whose responses are highly correlated (Sleenhoff et al., 2015; Watts & Stenner, 2005). As such, the factor analysis provides information about similarities and differences in participant subjective reactions for each dimension.

Two distinct subgroups emerged in relation to the emotional responses to the images: Emotion Group A (n = 14) and Emotion Group B (n = 7). The Q-sorts from two participants were removed from the analysis as they failed to load onto a single subgroup. Combined, these groups explained 61% of the variance in the Q-sorts. It is worth noting that in social science and humanities research the explained variance for factor analysis is commonly between 50% and 60% (Pett, Lackey, & Sullivan, 2003). The individual factor loadings for each of the participants can be found in Table 2.2.

Table 2.2. Factor Loadings of the Subgroups for the Emotional Reaction, Perceived Topic Congruency, and Personal Relevance Dimensions

Participant ID	Emotional Reaction		Topic-Congruency		Personal Relevance				
	Group A (n = 14)	Group B (n = 7)	Group A (n = 17)	Group B (n = 5)	Group A (n = 8)	Group B (n = 3)	Group C (n = 3)	Group D (n = 3)	Group E (n = 3)
1	0.7058X	0.3324	0.6160X	0.0916	-0.0854	0.6381X	-0.0298	0.0570	-0.0680
2	0.7812X	0.1590	-0.0336	0.7190X	0.7540X	0.0641	0.1137	-0.2032	0.0370
3	0.5693	0.6539X	0.6404X	0.3072	-0.2778	0.6713X	0.3126	-0.0469	0.1418
4	0.4852X	0.3278	0.6021X	0.1874	0.2474	0.1391	0.5004X	0.1908	0.3767
5	0.6071X	0.3227	0.5746X	0.1063	0.4670	-0.0154	-0.0765	-0.1207	0.5311X
6	0.7365X	0.0801	0.0640	0.6445X	0.6704X	-0.2138	-0.3144	0.3228	-0.0831
7	0.6041	0.6203	0.5827X	0.2236	0.0686	0.0255	0.1332	0.8677X	-0.0457
8	0.6933X	0.3877	0.7023X	0.4340	0.0342	0.1159	-0.0833	0.0548	-0.0346
9	0.5514	0.6815X	0.7919X	0.2744	0.6487X	0.3244	-0.0132	0.2436	0.2514
10	0.4304	0.4038	0.7760X	0.1895	-0.0659	0.0677	0.8113X	0.0182	-0.1072
11	0.2520	0.8361X	0.6087X	-0.0809	0.0717	-0.1922	0.6755X	-0.0967	-0.1700
12	0.2841	0.6511X	0.8561X	-0.0523	0.1867	-0.0419	-0.1397	0.1485	0.7954X
13	0.5451X	0.3562	0.7434X	0.3099	0.7868X	-0.0789	-0.1830	-0.0823	0.2059
14	0.7190X	0.4511	0.8017X	0.0079	0.2416	0.1216	-0.0032	0.3683X	0.0874
15	0.0664	0.7104X	0.7755X	0.1096	0.7145X	0.1018	0.1079	0.0219	0.1992
16	0.3566	0.7880X	0.5789	0.5679	0.4894	0.4609	0.1088	0.1065	0.0067
17	0.6176X	0.5205	0.7721X	0.0835	0.2697	0.1512	-0.0214	0.3082	0.4810X
18	0.3497	0.7024X	0.3349	0.7158X	0.5280X	-0.1063	0.3710	0.3623	0.0644
19	0.6891X	0.5522	0.1962	0.7478X	-0.0274	0.1459	-0.1657	0.6840X	0.2213
20	0.5779X	0.4621	0.0085	0.6708X	0.2309	-0.1118	0.0247	0.0797	0.0871
21	0.6616X	0.3252	0.6385X	0.1988	0.6802X	0.0376	-0.2550	0.1986	0.3207
22	0.7143X	0.4416	0.6522X	0.3763	0.6776X	-0.1839	0.2271	0.2544	0.0002
23	0.7857X	0.2086	0.8172X	0.0324	0.1803	0.8115X	-0.2101	0.1581	-0.0314
Explained variance	34%	37%	39%	16%	20%	9%	9%	9%	7%

Note. 'X' indicates which sub-group each participant's Q sort aligned with.

Two distinct subgroups also emerged in relation to the perceived topic congruency: Topic congruence Group A (n = 17) and Topic congruence Group B (n = 5). The total explained variance was 55% (see Table 2.2). One participant's Q-sort was removed as it failed to load onto a single subgroup. See Table 2.2 for the individual factor loadings of the participant.

The image rankings with respect to personal relevance, however, produced highly variable responses, as evidenced by the emergence of five subgroups with a total cumulative percentage of variance explained of 54%. The largest subgroup had eight participants (Personal relevance Group A), with the remaining four subgroups (Personal relevance Groups B, C, D, and E) containing three participants in each (see Table 2.2). Three participants, whose image Q-sorts failed to load onto a single group, were excluded.

While identifying whether community members' responses to the image categories converged or diverged was a clear aim of the study, we were unable to draw any conclusions about the antecedents to their differing response. For each dimension, no statistically significant differences were identified between any of the subgroups in terms of their socio-demographics, knowledge, attitudes, and behavior (ps > .05). Furthermore, as can be seen in Table 2.2, there was not a clear overlap between the subgroups across the three dimensions. That is, participants who reacted similarly to the images in terms of perceived topic congruence often reacted differently in terms of perceived topic congruence and personal relevance.

2.4.2. Patterns of responses for subgroups according to image category

For each subgroup identified within each of the three dimensions, every image was given a normalized factor score (ranging from −6 to 6). This "idealized sort" represents a distinct pattern of preferences among the subgroup for that particular dimension. With respect to the emotional response dimension, images with high factor scores (i.e., with factor scores ≥4) elicited the most positive emotion response, while those with a high negative score (≤−4) elicited the least positive emotional response. In terms of the topic congruency dimension, images with high positive factor scores were perceived to be highly congruent with the issue of stormwater management, whereas those with a high negative score were perceived as having low topic congruency. Finally, for the personal relevance dimension, a high positive factor score indicated that people could personally relate to the image, whereas, a high negative factor score denoted a lack of personal connection with the image. The ranking of each image for each dimension, based on the factor scores for each subgroup' inverted factor analysis, can be seen in Table 2.3.[5] The table highlights the overall degree to which categories of images aligned with the dimension in question for each of the related subgroups. For example, how the two emotion subgroups were similar or different in their

[5] A full list of factor scores for all 70 tested images can be provided by contacting the first author.

emotional responses to the four categories of images. In the section below, we describe the results and use the qualitative responses to guide our understanding of why the subgroups emerged.

Table 2.3. Image Factor Scores for Emotional Response, Perceived Topic Congruence, and Personal Relevance Q-Sorts

Image (Image No.)	Positive emotion response		Topic-Congruence		Personal Relevance				
	Sub-group A (*n* = 14)	Sub-group B (*n* = 7)	Sub-group C (*n* = 17)	Sub-group D (*n* = 5)	Sub-group A (*n* = 8)	Sub-group B (*n* = 3)	Sub-group C (*n* = 3)	Sub-group D (*n* = 3)	Sub-group E (*n* = 3)
Traditional Infrastructure									
Gross pollutant trap (1)	-	--	++	++	-	-	0	+	-
Stormwater pipes (12)	--	-	+	++	--	-	0	-	+
Stormwater drain (17)	-	-	++	++	--	-	0	-	-
Stormwater drain (37)	--	--	++	++	-	--	+	+	+
Stormwater drain (39)	--	-	++	+	-	-	+	0	--
Stormwater outlet (41)	--	-	++	+	-	--	0	+	0
Pollutant trap (59)	--	--	++	++	--	--	+	-	--
Stormwater drain (62)	--	--	++	++	--	--	++	++	--
Flood event									
Flood clean-up (20)	++	--	+	0	+	0	++	++	+
Flood clean-up (60)	++	-	++	0	++	++	++	0	0
Flash flood (27)	-	--	++	-	0	++	+	+	--
Aerial shot (7)	--	--	++	-	0	+	+	++	-
Management innovation									
Greenwall (66)	+	+	-	--	0	0	++	+	++
Wetland (19)	+	0	0	0	0	++	0	0	0
Raingarden (33)	+	0	0	-	+	0	0	0	+
Wetland (34)	0	0	0	0	0	-	0	-	0
Wetland (40)	0	0	0	0	-	-	+	0	0
Wetland (61)	0	0	+	0	0	0	0	0	-
Raingarden (49)	0	0	0	0	0	+	++	0	+
Raingarden (53)	0	0	0	+	0	+	-	-	-
Raingarden (56)	0	0	+	+	-	0	-	--	0
Raingarden (18)	0	-	0	-	0	0	-	0	-

Image (Image No.)	Positive emotion response		Topic-Congruence		Personal Relevance				
	Sub-group A (*n* = 14)	Sub-group B (*n* = 7)	Sub-group C (*n* = 17)	Sub-group D (*n* = 5)	Sub-group A (*n* = 8)	Sub-group B (*n* = 3)	Sub-group C (*n* = 3)	Sub-group D (*n* = 3)	Sub-group E (*n* = 3)
Raingarden (63)	0	-	0	-	-	0	-	0	0
Raingarden (52)	+	0	0	--	+	0	+	-	+
Wetland (2)	-	0	+	0	-	0	0	-	-
Treepits (50)	-	0	-	--	-	0	0	--	-
Raingarden (67)	-	0	+	++	-	+	-	--	-
Raingarden (51)	-	-	-	-	-	+	0	--	-
Oceanic environment									
Turtle (11)	++	++	--	++	++	--	+	++	++
Moreton Island (26)	++	++	--	+	++	-	--	+	++
Coral reef (31)	+	++	--	+	+	--	--	0	++
Marine creature (21)	+	++	--	+	++	--	-	-	++
Dolphin (24)	0	++	--	+	++	--	+	0	++
Turtle with plastic (43)	--	--	-	++	++	--	++	--	--
Coral with plastic (28)	--	--	-	++	++	0	++	0	--

Note. ++ indicates a factor score of 4, 5, or 6; + indicates a factor score of 2 or 3; 0 indicates a factor score of 1, 0, or −1; − indicates a factor score of −2 or -3; −− indicates a factor score of −4, −5, or −6.

2.4.3. Images depicting traditional stormwater infrastructure

This category of images depicted stormwater drains, outlets, pipes, and gross pollutant traps (see Figure 2.2). No people or animals were visible. For both the emotional and topic congruency dimensions, images of stormwater infrastructure elicited a similar response from all identified subgroups (see Table 2.3).

Figure 2.2. Gross pollutant trap (supplied courtesy of Bendigo City Council)

First, in terms of emotions, the images elicited very low levels of positive emotions across both emotion subgroups and indeed the qualitative comments suggested the presence of very negative emotional reactions. For example, one participant summarized their feelings toward this category of images as, "I think they are negative because they have a lot of rubbish in them" (ID16). The dominant emotion elicited by the images was disgust, with typical responses including "yuck," "ugly," "disgusting," and "revolting." For example, when presented with an image showing a gross pollutant trap (see Figure 2.2), one participant stated, "Unpleasant…the system is kind of working in that we have something in place to trap rubbish, but the rubbish is still there" (ID3). Unsurprisingly, stormwater infrastructure images were perceived to be highly topic congruent by both of the subgroups, with participants commenting that images depicting drains were "most relevant" (ID17). Furthermore, many participants were cognizant of the fact that the stormwater infrastructure was designed to minimize the risk of flooding as evidenced by this comment: "Good drainage is important in cities and towns so you don't get flooding" (ID11).

It was only in terms of perceived personal relevance that differences between the subgroups were evident. For example, for three of the subgroups for this dimension (Personal relevance Groups A, B, and E), images of traditional stormwater infrastructure dominated those images

ranked as being least personally relevant. Comments such as “I can’t see any relevance to my life” (ID14) were common. Conversely, for the remaining two smaller groups (Personal relevance Groups C and D), some of the infrastructure images fell above the midpoint for personal relevance. For these participants, their personal familiarity with the infrastructure seemed to drive their responses. For example, when presented with an image of a roadside stormwater drain (Image 62), one participant commented, “It’s things that you see a lot in the inner city, which is drainage grates full of rubbish” (ID11).

2.4.4. Images depicting flood events

The flood images included an aerial shot of a major flood event and an image of a flash flood at a sporting field (see Figure 2.3). Two other images depicted people engaging in flood clean-up activities. As can be seen in Table 2.3, two of the flood-related images (Images 7 and 27) elicited negative emotional responses across both emotion subgroups, with the dominant emotion being sadness. To illustrate, a participant stated, “Flooding is no good for anybody, people lose so much through that, their homes, their memories, their photos, so it’s unpleasant” (ID14). In contrast, the two images depicting post–flood clean-up events (Images 20 and 60) received mixed emotional responses. For the majority of the participants (Emotion Group A), the images elicited a very positive emotional response—for example, “Positive because it shows people working together to clean up the environment” (ID8). Conversely, the smaller subgroup (Emotion Group B) continued to have a very negative emotional reaction to the images, as exemplified by the statement, “Makes me feel pretty sad about all that” (ID7).

Figure 2.3. Flash flood (supplied courtesy of Brisbane City Council)

With regard to topic congruency, flood images were ranked highly by the majority of the participants (Topic congruency Group A). Participants from the smaller subgroup (Topic congruency Group B) indicated that they felt images of ocean environments better reflected the importance of managing stormwater for catchment health (refer to following section). This was despite indicating that they also understood the relevance of flood images to the topic—that is, "That's relevant in its own way" (ID6).

Across all the image categories described in this report, flood images elicited the most consistently positive response in terms of perceived personal relevance. Images that consistently scored above the midpoint for personal relevance were rare and, excluding one small subgroup (Personal relevance Group E), all four flood images were ranked above or near the midpoint for personal relevance. However, it is important to note that this is likely because residents of Brisbane experienced a major flooding event in 2011, as evidenced by this comment: "Got caught in the floods, pretty relevant" (ID16). For those participants without firsthand experience of flood events, the resonance came from an appreciation of people's efforts. As one participant noted, "I like these because at least they are trying to do something" (ID10).

2.4.5. Images depicting stormwater management innovations

This category of imagery encapsulated innovations in stormwater management infrastructure, including constructed wetlands (see Figure 2.4), raingardens, tree pits, and greenwalls. The ranking of the images can be seen in Table 2.3. In terms of an emotional response, these images tended to elicit neutral emotional responses across both subgroups. This reaction was exemplified by one respondent who noted, "Getting towards neutral [feelings]—these [images] are just more it's nice to be able to go for a walk in the urban space" (ID8). Interestingly, of the four images in this category to receive moderately positive responses from Emotion Group A, three depicted a person in the image (Images 19, 33, and 52).

Figure 2.4. Constructed wetland (supplied courtesy of Healthy Waterways)

Similarly, the large majority of images included in this category failed to receive high positive scores in terms of topic congruency. Participants generally failed to identify that the infrastructure had a purpose in terms of managing the impact of stormwater. With respect to greenwalls (Image 66), one participant noted, “I’m not sure whether greenery growing up a wall is actually relevant” (ID6). An image of a raingarden received a similar response: “It’s just a bit of raised [garden] bed . . . don’t think that affects the waterways in any way” (ID2). These responses suggest that the low levels of topic congruence may emanate from poor knowledge about these structures. Images in this category that scored above the midpoint for this dimension were those that included visible traditional stormwater infrastructure. For example, in response to an image of a raingarden one participant stated, “I can see a drain, so that is relevant” (ID2).

Consistent with the pattern of responses for the emotional response and topic congruency dimensions, images of stormwater management innovations generally failed to score highly in terms of the personal relevance dimension. For each of the subgroups, however, a very small number of images did score highly (see Table 2.3). An examination of the qualitative comments indicated that perceptions of value and familiarity may have been responsible for these rankings. For example, an image of a raingarden aroused a value-based comment: “Talks to my sense of the environment and city living and what we should do to make it more habitable, not only for us but for birds and bees and for the environment in general” (ID6). Another participant responded to a raingarden image in terms of familiarity: “Less relevant, but still familiar, just things that you don’t see every day” (ID3). The only two images ranked above the midpoint by the largest subgroup (Images 33 and 52; Personal relevance Group A) were those that included a person visible in the image.

2.4.6. Images depicting bodies of oceanic environments

This image category included ocean environments with living creatures present in some but without any visible people, buildings, or boats (see Figure 2.5). There was a high degree of similarity across the two emotion subgroups with respect to oceanic images. As can be seen in Table 2.3, pictures of pristine ocean environments consistently elicited high levels of positive emotion. Across all image categories, the image of a turtle swimming in the ocean (Image 11) was the most highly ranked in terms of positive emotions, followed by an aerial shot of an island (Image 27). The images were commonly described as "beautiful" or "calming." For example, "Beautiful setting. Looks very relaxing. I'd like to be there" (ID 3).

Figure 2.5. Plastic bag (supplied courtesy of Healthy Waterways)

Conversely, the two images depicting pollution in ocean environments consistently elicited very low scores and highly negative verbal emotional responses. For example, an image of a plastic bag floating near a coral reef (Image 28, see Figure 2.5) had the lowest factor score across both the emotional engagement subgroups. The dominant emotions elicited by images of oceanic degradation were reported as sadness and distress, as highlighted by this response to an image of a turtle ingesting a plastic bag: "I want to cry when I look at that, it's terrible, it shouldn't happen" (ID2).

However, with regard to topic congruence, the two identified subgroups had very different responses (see Table 2.3). The larger of the groups (Topic congruence Group A) perceived images of ocean environments as having little relevance to stormwater management. An indicative response was "The ocean's always been around and I don't necessarily associate it with stormwater" (ID17). In contrast, images of ocean environments were perceived to have high topic congruence for the

smaller subgroup (Topic-congruence Group B). For instance, one participant commenting on the plastic bag in the ocean image noted, "It's relevant in the sense that it gets into the stormwater drains and then goes out to sea" (ID6). This response suggests that members of the smaller subgroup may have had a more nuanced understanding of the dynamics of stormwater management. In terms of personal relevance, the oceanic images received mixed results, with the largest subgroup for this dimension (Personal relevance Group A) as well as Personal relevance Groups C and E ranking such images as highly personally relevant (see Table 2.3). Again, the qualitative comments indicated that familiarity was highly influential in the ranking for this dimension. As one participant noted, "I grew up in North Queensland, so the coast and the environment are important to me" (ID6). Furthermore, participants from the other subgroups (Personal relevance Groups B and D) stated that it was a lack of familiarity that explained why they did not consider these images as highly personally relevant. To illustrate, "I am not a beach person, all these open ocean type images are not part of my normal experience" (ID3).

Across all five subgroups, however, oceanic images that included an animal tended to be ranked higher in terms of personal relevance. For example, all of the subgroups bar one (Personal relevance Group B) ranked an image of a turtle above the midline for personal relevance. One participant stated, "[These] are very impactful and hard hitting, it's animals being directly affected by pollution" (ID11). Indeed, for the largest subgroup on the personal relevance dimension, six of the highest ranked images were of animals in natural settings.

2.5. Discussion

This study sought to extend previous research on how images engage people with environmental issues by identifying which categories of images (a) evoked an emotional response; (b) were perceived to be congruent with the topic, and (c) were perceived as personally relevant. These aims were explored in the context of SUWM.

Two groups were identified in terms of which images were likely to elicit either positive or negative emotions, with a large majority of participants forming a single group (n = 14 vs. n = 7). Despite the emergence of two groups, there was a high degree of consensus. Looking across the image categories, the images that consistently elicited the strongest emotional responses were the oceanic images. For images of clean and pristine ocean environments, the dominant emotion elicited was calmness/serenity. Conversely, strong negative emotional responses were evoked by images depicting pollution in ocean environments; with the dominant emotion being sadness. Images of traditional stormwater infrastructure also elicited negative emotional responses. The qualitative data indicated that the dominant emotion was disgust. Differences between the two emotion subgroups were evident only when considering the images of flood clean-up events, whereby this type of imagery elicited a very positive emotional response from the larger subgroup

but a negative emotional reaction from the smaller subgroup. The qualitative comments indicate that the majority of the participants were able to shift their focus away from the flood itself, which consistently elicited feelings of sadness, to instead focus on the people depicted in the picture, reporting that they felt a sense of community and pride in the actions of others. Understanding the specific emotions, like sadness or pride, elicited by different images is important as there is growing evidence that different emotions lead to different outcomes. For example, a study by Kühne and Schemer (2015) found that when readers of a news article that discussed proposed public policy measures designed to increase road safety were induced to feel angry, they expressed a preference for punitive measures. In comparison, readers induced to feel sadness expressed a preference for more remedial measures.

Two groups were also identified in terms of judgments of the congruence of the images to stormwater management. Again, the large majority of participants formed a single group (n = 17 vs. n = 5). While images of traditional stormwater infrastructure and flood events were perceived as having high topic congruence across the two subgroups, images of oceanic environments received a mixed response. The smaller subgroup (Topic congruence Group B) for this dimension ranked ocean images as highly congruent, whereas the larger subgroup (Topic congruence Group A) ranked the images as highly incongruent. It was evident that the discrepancy was largely driven by the larger group's inability to understand the impact of stormwater on ocean health. Furthermore, both of the subgroups failed to recognize more recent stormwater management innovations, such as raingardens and greenwalls, in terms of their role in managing the impacts of stormwater. These findings suggest that the use of either oceanic images or images of new stormwater management innovations could potentially undermine peoples' ability to engage fully with a communication message because the images are not perceived as congruent with the issue (Smith & Shaffer, 2000; Tangen et al., 2011). The findings also indicate that community members can hold a very shallow understanding of stormwater management that does not extend past flooding and traditional stormwater infrastructure. This is perhaps not surprising given the low levels of stormwater-related knowledge reported by the participants in the post Q-sort survey, and it suggests a need for future education campaigns that address the identified gaps in their knowledge.

Interestingly, irrespective of image type, images ranked as being highly topic congruent were also more likely to evoke negative emotions, and vice versa. For example, images of stormwater infrastructure were judged as both congruent and unpleasant, whereas images of oceans were judged as beautiful and calming but largely incongruent (by the majority of participants). A similar juxtaposition between emotion and perceived topic congruence is also evident in research on climate change imagery (O'Neill & Nicholson-Cole, 2009), where images ranked as unrelated to climate change were those also noted as being positive (e.g., sunflower crops and trams). This

presents a unique challenge to communicators of pro-environmental messages in terms of identifying images that are both congruent with the topic and elicit the desired emotion.
The ranking of the images with respect to personal relevance resulted in highly variable responses, as evidenced by the emergence of five distinct subgroups. Although the subgroups nominated different images as being personally relevant across the different image categories, the reasoning given for their selection was very similar; images that were familiar to the participants were perceived as having high personal relevance and this held across all the different image categories. Similarly, O'Neill and Nicholson-Cole (2009) and Leviston (2013) both reported that localized images resonate strongly with viewers. Drawing on these findings, practitioners should consider using visual imagery depicting localized content when devising pro-environmental communication campaigns.

Beyond familiarity, the category of images depicting bodies of oceanic environments were ranked as the most personally relevant by the largest of the subgroups for this dimension (Personal relevance Subgroup A) as well as two of the smaller subgroups (Personal relevance Groups C and E). In particular, the images of a turtle (Image 11) and, to a slightly lesser extent, that of a dolphin (Image 24) were consistently ranked as highly personal relevant by the majority of the participants. This is not surprising given peoples' tendency to anthropomorphize animals (Epley, Waytz, Akalis, & Cacioppo, 2008), which in turn could influence their ability to relate to the image.

Although a large number of images (n = 16) of new stormwater management initiatives (e.g., raingardens, greenwalls, and artificial wetlands) were included in the Q-sort, this category of images did not rank highly across any of the three focal dimensions—that is, these images did not consistently elicit a strong positive emotional response, were not considered highly congruent to the topic of stormwater management, and were not perceived as highly personally relevant. Interestingly, the few images in this category that received moderately positive responses were those that depicted a person in the image (Images 19, 33, and 52). This finding highlights the value of depicting people in images as a way of increasing their engagement and closely aligns with research conducted in the climate change context (Braasch, 2013; Chapman et al., 2016; Nicholson-Cole, 2005).

Interestingly, images that ranked highly in terms of positive emotional responses were often ranked highly in terms of perceived personal relevance. For example, an image of people cleaning up flood-induced stormwater after the Brisbane 2011 floods elicited a strong positive emotional response for the largest subgroup and was also ranked highly by three of the five subgroups on the personal relevance dimension. On the other hand, images that were consistently ranked highly in terms of topic congruence (i.e., images of traditional stormwater infrastructure) failed to rank highly in terms of personal relevance for the large majority of the participants. Indeed, this category of

images was consistently the lowest ranked for perceived personal relevance of all the included image categories. This tension between personal relevance and topic congruence is also prevalent in climate change communication. For example, research conducted by Corner et al. (2015) found that images depicting peoples' everyday lives (i.e., images that would be perceived as having high personal relevance) were not perceived as being relevant to the topic of climate change. This presents a challenge for practitioners seeking to find the balance between images that appeal to the broader public and are understood as congruent with the topic being communicated.

Our findings suggest that perhaps the greatest opportunity for the communication of SUWM initiatives are images depicting flood-related events, as this category of images was consistently ranked highly across all three focal dimensions. That is, the images in this category tended to elicit a strong emotional response (either negative or positive), were perceived as congruent to the topic, and, more so than any other set of images, were ranked above the midpoint in terms of personal relevance. This finding is not surprising given that the study location (Brisbane, Australia) experienced a major flooding event in 2011. The finding suggests that practitioners seeking to bolster message engagement through imagery would do well to identify a localized, historic event that speaks to the issue at hand. It is also worth noting that two of the images (Images 20 and 60) depicted people, and this further highlights the importance of including human elements in images (Braasch, 2013).

As with all research, the current study had limitations that may limit the generalizability of the findings. First, it is unclear how the results of this study would generalize outside of the context of communications about SUWM and beyond the specific geographic location of the study (i.e., Brisbane, Australia). Further research is needed to confirm the reliability and validity of our findings across different geographic areas and in other environmental contexts. Furthermore, no statistical differences were identified between the subgroups in terms of their sociodemographics, knowledge, attitudes, or behaviors. Therefore, beyond identifying that the subgroups often differed in terms of how they reacted to the images for each of the three dimensions, the study was unable to infer key antecedents for their differing responses. This suggests that other factors not considered by the current study may be driving the differences in subjective reactions to the sampled images, as the qualitative data suggest. It is worth noting, however, that this is a common limitation in Q-methodology research as "Q-method does not result in data that is interpretable in relation to the proportion or characteristics of people holding a particular view" (Beckham Hooff et al., 2017, p. 719). As such, although the identification of the subgroups provided important insights into the convergence and divergence of responses across the image categories, more research is needed to supplement our understanding of the psychosocial profile of the subgroup members. Last, as this was an exploratory study, the causal effect of the images on engagement (i.e., knowledge, attitudes,

and behavior) was not assessed. Future research is therefore needed to empirically assess the capacity of the images categories identified in this study as having strong engagement potential, images of localized impacts for example, to positively influence attitudes, cognitions, and behaviors more broadly.

2.6. Conclusion

The current study contributes to research exploring how different types of images can connect people with scientific and/or pro-environmental issues. At a practical level, the research findings will be beneficial in guiding the development of future SUWM communication materials likely to appeal to a broad base of community members. Taken together, the findings illustrate the need for greater focus on selecting imagery that matches the goals underpinning the message. If, for instance, the goal is to have message recipients feel good about a SUWM policy, then embedding imagery of stormwater infrastructure may be counterproductive. Conversely, such imagery may be helpful if the goal is to help message recipients recognize the connection to stormwater management. Finally, the results suggest that if the goal is to increase the personal relevance of SUWM, then including images of familiar landscapes and/or people and animals would be beneficial to achieving this aim.

At a theoretical level, this research builds on, and extends, past research exploring the ways in which images can engage people with pro-environmental and scientific issues. It contributes to the nascent research in this area by exploring an image's ability to create an emotional connection, to be perceived as congruent to the topic, and to have personal relevance; which are important determiners of engagement with pro-environmental imagery in addition to self-efficacy and issue salience.

An important next step will be to extend the current research to explore the impact of pairing different image categories with text, as images are most often situated within text-based communications (Hart & Feldman, 2016). Indeed, within the context of climate change communication, Hart and Feldman (2016) found that pairing images of climate solutions with matching text increased engagement (i.e., individuals' perceptions of self-efficacy). Accordingly, the results of the current research are being used to guide the development of experimental research to test the impact of different discrete emotions identified during the Q-sort (i.e., disgust, sadness, and calmness; see Scherer, 2005) on how people process and engage with written communication messages about SUWM.

2.7. Conflicts of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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CHAPTER 3

3. Overview

In the previous two chapters, it is argued that images eliciting integral emotions can influence how individuals process an accompanying message and, by doing so, influence overall engagement with the message topic. The results of Study 1 suggest that some images commonly used in communications about sustainable stormwater management elicit the discrete emotions of disgust and sadness (Schultz, Fielding, & Newton, 2018). For example, images of stormwater infrastructure and rubbish in stormwater drains typically elicit disgust whilst images showing the impact of stormwater pollution on animal or ocean health elicit sadness. However, the results of the exploratory research cannot establish the causal effect of the emotion elicited by each respective image on depth of processing and overall message engagement.

The results of past research exploring the effect of incidental discrete emotions on depth of processing suggest that disgust and sadness will have differential effects (Tiedens & Linton, 2001). This thesis seeks to extend this research by conducting experimental studies to examine whether these findings translate to integral emotions and to the context of stormwater management. The presented studies test effects of images that elicit either high or low levels of disgust (Study 2, N = 235) and images that elicit either disgust or sadness (Study 3, N = 388) on depth of message processing and engagement with the related message, as well as whether the personal relevance of the topic (as measured by strength of environmental identity) moderated the effects. This chapter presents a manuscript that has been accepted for publication in the *Journal of Environmental Psychology* (Schultz, Fielding, Newton, & Louis, 2018) and can be read as a stand-alone content. However, because it is a manuscript, it contains information that overlaps with the theoretical framework outlined in Chapter 1 and the study numbers do not align. Study 2 for the thesis is referred to in the manuscript as Study 1 and Study 3 for the thesis is referred to in the manuscript as Study 2. Again, the spelling and formatting align with the journal requirements.

Schultz, T., Fielding, K., Newton, F., & Louis, W. (2018). The effect of images on community engagement with sustainable stormwater management: The role of integral disgust and sadness. *Journal of Environmental Psychology, 59*, 26-35. doi: https://doi.org/10.1016/j.jenvp.2018.08.003

3.1. Abstract

Drawing on the Appraisal-Tendency Framework of emotion we tested a conditional pathway model across two experiments with community members (N = 235 and N = 388) using pro-environmental messages that included images eliciting either disgust or sadness. We tested the effects of images on message engagement (i.e., attitudes, knowledge, and behavioural-intention) via depth of processing and whether strength of environmental identity moderated these effects. As predicted, for people with lower levels of environmental identity, the disgust image conditions led to lower overall engagement with the message content indirectly via lower depth of processing, compared to a no image control condition (Study 1 and Study 2) or a sad image (Study 2). Contrary to what was predicted, the effect of the sad image condition did not increase depth of processing relative to the control condition (Study 2). The key finding suggests that disgusting images should be avoided in pro-environmental communication.

3.2. Introduction

We live in a world increasingly rich in images (e.g., websites and social media; Lazard & Atkinson, 2015; Rodríguez Estrada & Davis, 2015). Although images can be an effective way to engage people with pro-environmental issues (Larson & Edsall, 2010; O'Neill & Smith, 2014), some images are likely to be more effective than others are and some may even be detrimental. The research to date investigating the effects of images on pro-environmental engagement has focused predominantly on images related to climate change. Furthermore, prior research (e.g., Chapman, Corner, Webster, & Markowitz, 2016; O'Neill, 2013; O'Neill & Nicholson-Cole, 2009) has tended to focus on how people react to the images in isolation of the accompanying text. As such, the capacity for images to alter message processing in pro-environmental contexts has been largely overlooked (Lazard & Atkinson, 2015; Rodríguez Estrada & Davis, 2015). We identified only one study that investigated the effect of still images (i.e., photographs) and text in a pro-environmental context. The study, conducted by Hart and Feldman (2016), manipulated both climate change imagery and text to assess the effect of different combinations on intentions to engage in climate change-related political behaviour. The results showed that the combination of solar panel images with text that discussed actions to address climate change positively influenced participants' willingness to take action. This nascent research demonstrates that different combinations of images and text can influence peoples' engagement with environmental issues (Hart & Feldman, 2016).

We extend the research in this area by moving beyond the context of climate change communication to examine how images embedded in messages affect message processing and subsequent engagement with the issue of sustainable urban water management. In line with a global trend (Zheng, Westra, & Leonard, 2015), extreme rainfall events are increasing in frequency

(Bureau of Meteorology & CSIRO, 2016). Given extreme weather events have the potential to create "more damage and thus adversely affect society more than long term changes in the mean climate that are attributed to anthropogenic greenhouse gas emissions" (Thompson & Otto, 2015, p. 439), governments across the globe are investing substantially in sustainable urban stormwater management initiatives to address these challenges (Cettner, Ashley, Hedstrom, & Viklander, 2013). Sustainable urban stormwater management represents a transition away from traditional urban water management practices, which focus on pipes and sewer systems, to more environmentally sustainable solutions such as raingardens, wetlands, and permeable paving (Wong & Brown, 2008). Establishing evidence around images that engage or disengage communities could assist in this transition (Corner et al., 2015; Nicholson-Cole, 2005; O'Neill, 2013, O'Neill and Hulme, 2009).

Early exploratory research conducted by the authors established that images commonly used in communications about sustainable urban stormwater management elicit the discrete, integral emotions of disgust or sadness (Schultz, Fielding, & Newton, 2018). Integral, discrete emotions are defined as psychological reactions of varying intensity and duration elicited in response to a target stimulus (Kühne & Schemer, 2015; Nabi, 2002, 2003). They are distinct from incidental emotions, which are emotional reactions unrelated to a target stimulus (e.g., Kühne & Schemer, 2015; Nabi, 2002, 2003). Past research drawing on the Elaboration Likelihood Model (Petty & Cacioppo, 1986) and the Appraisal-Tendency Framework of emotion (Lerner & Keltner, 2000, 2001) suggests that discrete emotions differentially influence depth of processing and engagement. However, past research has tended to focus on incidental emotions and has largely ignored the role of images as an antecedent to the emotion elicited. Therefore, understanding how related, emotional imagery influences depth of processing, and ultimately engagement with the focal issue, has important practical and theoretical implications.

3.2.1. The Elaboration Likelihood model

The literature on message processing is dominated by dual-process theories, of which the Elaboration Likelihood Model (ELM) is one of the most widely used (Gawronski & Creighton, 2013; Lazard & Atkinson, 2015; Petty & Cacioppo, 1986). The ELM posits that the way people process messages varies along a continuum (Petty, Cacioppo, & Kasmer, 1998). At one end, people use a very shallow depth of processing, referred to as the peripheral path. When messages are processed peripherally, contextual factors, such as the perceived expertise of the sender, have a large impact on the persuasiveness of the message (Petty & Wegener, 1998). At the other end, referred to as the central path, an individual carefully scrutinises and elaborates (i.e., thinks deeply about and focuses) on the content of the message (Petty & Cacioppo, 1986; Petty & Wegener, 1998). Research suggests message content has the strongest effect on attitudes and behaviour when

it is processed via the central path (Petty & Cacioppo, 1986; Petty & Wegener, 1998). As such, when trying to create lasting attitudinal and behavioural change, as is the case with many pro-environmental communications, it is most desirable to have individuals' process messages through the central path (Meijnders, Midden, & Wilke, 2001; Petty & Cacioppo, 1986).

According to the ELM, the critical stage for determining whether a message will be processed more centrally or peripherally begins at the point of initial exposure (Lazard & Atkinson, 2015; Petty & Wegener, 1998). Both eye-tracking and brain imaging research have shown that images are the first thing that people focus on when looking at a communication message (Enser, Sandom, & Lewis, 2005; Miller & Stoica, 2003; Yantis, 2005) and are processed faster than text (Sontag, 2017). This is especially true of emotional images. Specifically, viewers need just 240 ms to recognise a neutral picture, but even less time to process emotional images; 105 for negative images and 180 for positive images (Young, 2016). Given images used in pro-environmental communications are often highly emotive (Leiserowitz, 2006; O'Neill, 2013), they have the potential to influence how people process the accompanying written message (Lazard & Atkinson, 2015). We draw on the Appraisal-Tendency Framework of emotion (Lerner & Keltner, 2000, 2001) to understand how the emotions of disgust and sadness influence depth of processing. These discrete emotions were chosen as research suggests they are commonly reported in relation to urban stormwater imagery (Schultz, Fielding & Newton, 2018).

3.2.2. The appraisal-tendency framework

The Appraisal-Tendency Framework (ATF) provides insight into how disgust and sadness might differentially affect depth of processing by identifying the cognitive dimensions underlying each emotion (Smith & Ellsworth, 1985; Lerner & Keltner, 2000, 2001). For instance, past research linking the ELM and the ATF has consistently shown that emotions that differ with regard to the cognitive dimension of certainty, have differential effects on depth of processing (Tiedens & Linton, 2001a). Within the ATF (Lerner & Keltner, 2000, 2001), the cognitive dimension of certainty refers to the degree to which future events seem predictable and comprehensible (high certainty) versus unpredictable and incomprehensible (low certainty/uncertain; Smith & Lazarus, 1993). Disgust, which is characterized by high levels of certainty (Smith & Ellsworth, 1985), is associated with more peripheral processing (Nabi, 1999; Tiedens & Linton, 2001a). Conversely, sadness is characterized by low levels of certainty (Smith & Ellsworth, 1985) and is associated with more central processing (Bodenhausen, Sheppard, & Kramer, 1994; Tiedens & Linton, 2001a). Essentially, a certain cognitive appraisal makes people feel confident in the outcomes of future situations and/or decisions, which in turn, lowers an individual's motivation to engage in central processing (Small & Lerner, 2008; Tiedens & Linton, 2001). Conversely, uncertainty gives people the sense that they should carefully examine the content before making a decision and is therefore

associated with more central processing (Small & Lerner, 2008; Tiedens & Linton, 2001). Tiedens and Linton (2001b), for example, examined the effect of incidental disgust and fear on depth of processing and found that participants who experienced the emotion of disgust (high certainty) were more likely to engage in peripheral processing than participants who experienced the emotion of fear (low certainty). Similarly, people experiencing anger (high certainty) are more likely to use peripheral processing than people induced to feel sadness (low certainty; Bodenhausen et al., 1994). In sum, the ATF implies that disgust and sadness give rise to different certainty appraisals, which in turn influence depth of message processing.

Despite this pioneering research, we are far from having a complete picture of the effects of discrete emotions on depth of processing and, ultimately, engagement with the issue being communicated (Loewenstein & Lerner, 2003). With few exceptions (see Meijnders et al., 2001; Nabi, 1998), prior research has focused on incidental emotions (Mosier & Fischer, 2010). However, there is little that one can do to change these types of emotions within a pro- environmental communication campaign, as they happen prior to people receiving the stimulus. Conversely, integral emotions are elicited in response to a target stimulus and therefore offer communicators the opportunity to shape the emotions elicited. As such, it is important to understand whether the findings in relation to incidental emotions generalise to integral emotions. Moreover, a meta-analysis examining the effects of emotions on judgement and decision- making identified only two studies that assessed the effect of emotions on depth of processing, no studies using images as part of the emotional manipulation (although a large number used film clips) and no studies using an integral emotion manipulation (Angie, Connelly, Waples, & Kligyte, 2011). Thus, our research, which focuses on the emotions elicited by images relevant to the communication context, extends current understanding of the role of images and emotions on message processing and overall engagement with environmental messages.

3.2.3. The moderating role of personal relevance on depth of processing

As stated by Petty and Wegener (1998), “the most important variable influencing a person's motivation to think is the perceived personal relevance or importance of the communication” (p. 6). According to the ELM, when messages are perceived as personally relevant, recipients are more likely to engage in central processing of message content (Petty & Wegener, 1998). However, if the topic (or message) is not perceived as highly ‘involving’ by an individual or they feel unsure of its personal relevance, other more extraneous cues (e.g., message frames and emotions) influence message processing through more peripheral or heuristic processes (Petty et al., 2009; Petty, Cacioppo, & Schumann, 1983; Petty & Wegener, 1998). Within the environmental context, those with a strong environmental identity are likely to find environmentally-related information personally relevant and therefore this variable may influence depth of processing of environmental

messages. Consistent with this contention, research has shown that framing effects are only effective for participants with low levels of pre-existing involvement in environmental issues (Schultz, Dean, Newton, Ross, & Fielding, 2017; Van de Velde et al., 2010). We therefore assessed environmental identity as a key moderator of the impact of images on participant's depth of message processing.

3.2.4. Depth of processing and overall engagement with the message

In this paper we investigate the role of images that supplement text on issue engagement via depth of processing. We define engagement as a "personal state of connection with the issue … concurrently comprising cognitive, affective and behavioural aspects" (Lorenzoni, Nicholson-Cole, & Whitmarsh, 2007, p. 446). That is, a person is engaged to the extent that they know what the issue is (cognitive engagement), have positive or supportive attitudes towards the issue (affective engagement) and are motivated to take action (behavioural engagement; Dean, Lindsay, Fielding, & Smith, 2016). The elaboration likelihood model has been used extensively in past research to explore engagement with messages, including pro-environmental messages. For example, the effectiveness of communication messages in a zoo context (MacDonald, Milfont, & Gavin, 2016), picking up litter (Brown, Ham, & Hughes, 2010), recycling (Lazard & Atkinson, 2015) as well as climate change communication (Meijnders et al., 2001). This research has shown that low levels of message processing are associated with poorer cognitive engagement reflected by recall of message arguments (Bok & Min, 2013; MacDonald et al., 2016; Nabi, 2003; Smith & Shaffer, 2000), lower levels of affective engagement reflected by attitudinal support (Meijnders et al., 2001), and poorer behaviour and/or behavioural intentions (Brown et al., 2010; Petty & Wegener, 1998).

3.2.5. The current study

We designed two experimental surveys to assess the effect of context-relevant images that elicit either disgust (Study 1) and disgust or sadness (Study 2) on engagement with message content via depth of processing. In all conditions, and across both studies, participants read the same online pro-environmental factsheet about sustainable urban stormwater management initiatives.
By drawing on research which has previously integrated the ELM and the ATF (e.g. Tiedens & Linton, 2001a), we hypothesised that embedded images eliciting disgust would decrease participants' depth of processing of a message relative to a message without an image (Study 1 and Study 2) and relative to a message including an image known to elicit sadness (Study 2). This is because disgust activates high certainty, which in turn reduces depth of processing (Tiedens & Linton, 2001b). Conversely, sadness activates low certainty, which increases depth of processing (Bodenhausen et al., 1994). We further hypothesised that depth of processing would fully mediate the effects of the images on recipients' cognitive (i.e., message recall), affective (i.e., policy

support) and behavioural (i.e., intentions to discuss message contents with others) engagement. In Study 1, we also predicted that the negative relationship between images eliciting disgust and message engagement via depth of processing would be stronger in the high disgust image condition than the low disgust image condition. In Study 2, we further predicted that a message with an embedded image known to elicit sadness would increase message engagement via depth of processing relative to the same message without an image.

According to the ELM, messages perceived to be personally relevant are processed centrally (Petty, Cacioppo, & Schumann, 1983; Petty & Wegener, 1998). In our studies we assessed the personal relevance of environmental issues—as measured by the strength of environmental identity—on depth of processing. Specifically, we argue that people with stronger environmental identity are more likely to perceive a pro-environmental message as being personally relevant and therefore have high motivation to deeply process the factsheet content. As such, any emotion elicited by the image manipulation is unlikely to influence their depth of processing (Roh, Rickard, McComas, & Decker, 2018; Schultz et al., 2017). However, we predict this effect will be less likely or weaker for people with lower levels of environmental identity. Figure 3.1 outlines the predicted conditional pathway.

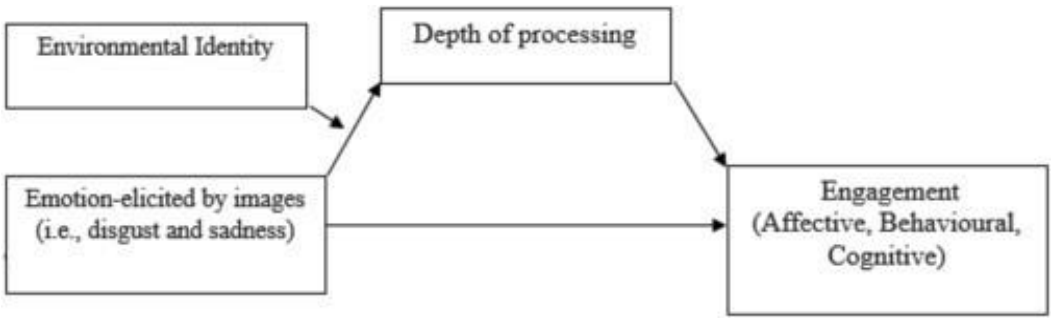

Figure 3.1. Conceptual diagram of the moderated mediation between the discrete emotions elicited by the target images on message engagement through depth of processing

3.3. Study 1

3.3.1. Method

Study 1, conducted in June 2016, used a 3-level (no image, low disgust image, high disgust image) between-subjects design. The experimental stimulus, a study-specific factsheet about sustainable urban stormwater management, varied only in terms of the image used. The factsheet was embedded within the questionnaire and hosted on the online Qualtrics platform.

3.3.1.1. Participants

In line with the results of a moderated-mediation simulation study conducted by Morgan-Lopez and Mackinnon (2006), a final sample size of approximately 300 was sought to achieve 80%

power. The data was collected via a paid on-line research panel with quotas used to ensure a relatively even balance of age and gender. A total of 462 respondents started the survey, of whom 78 failed to complete.[6] A further 149 respondents were excluded from the study for the following reasons: 12 completed the survey twice; 98 failed the attention check[7]; and 39 did not have English as their primary language. The final sample comprised 235 participants. Participants were randomly allocated to the control ($n = 80$), low disgust ($n = 76$) or high disgust ($n = 79$) condition. No significant differences were identified for any sociodemographic variables across conditions, confirming the success of the experimental randomisation, $ps > 0.098$ (Table S1 in the supplementary information shows the breakdown of sociodemographic factors by condition).

3.3.1.2.Procedure

After providing consent and answering demographic/control questions, participants were randomly assigned to one of two experimental conditions or to a control condition. For participants assigned to the low disgust image condition, the image was of a street with a stormwater drain and two visibly full garbage bags. In the high disgust image condition, the image was digitally manipulated to include garbage strewn around multiple garbage bags (see the supplementary information – Figure S1a). The embedded images were piloted on a student sample from Brisbane, Australia ($N = 51$, 68.63% Female, $M_{age} = 23.57$ years, $SD_{age} = 4.55$) to ensure that the dominant emotion elicited was disgust (see Supplementary information for results). In the control condition, no image was included. The factsheet included a brief definition of stormwater pollution and listed a number of actions that individuals and government agencies can take to help reduce stormwater pollution (see the supplementary information – Figure S3). After reading the factsheet, participants answered questions assessing their depth of processing as well as their cognitive (i.e., recall), affective (i.e., support for remedial policy) and behavioural (i.e., behavioural intentions as measured by intentions to discuss the message with others) engagement with the issue. Manipulation checks were also included to confirm that the image elicited the target emotion of disgust.

3.3.1.3.Measures

A complete list of all items for all measures has been included in the Supplementary Information.

Control Variables included socio-demographics and three control measures commonly used in ELM research: Need for Cognition, mood, and personal involvement (Petty & Wegener, 1998). Participants completed a modified, nine-item version of the Need for Cognition scale (1 = *Strongly*

[6] There was no significant difference across conditions, $\chi 2$ (2, $N = 410$) = 1.10, p = .949.

[7] There was no significant difference across conditions, $\chi 2$ (2, $N = 372$) = 0.06, p = .973.

disagree to 7 = *Strongly agree*; α = 0.90; Cacioppo & Petty, 1982; Manfredo & Bright, 1991), the well-established, 10-item International Positive and Negative Affect Schedule Short Form (1 = *Not at all* to 5 = *Extremely*; I-PANAS-SF; Karim, Weisz, & Rehman, 2011), and a 5-item modified version of the Personal Involvement Inventory (Zaichkowsky, 1994) on a scale from 1 = *important*/5 *unimportan*t or 1 = *relevant*/5 = *irrelevant*. The latter items were averaged to form an involvement scale (α = 0.92). Finally, drawing on prior research (Nabi & Prestin, 2016; Schultz & Fielding, 2014), perceived, context-specific knowledge was assessed by asking "How much do you think you know about stormwater management?" on a scale from 1 = *Nothing at all* to 5 = *A great deal*.[8]

Environmental Identity was assessed with three items drawn from past research (Fielding, McDonald, & Louis, 2008) on a scale from 1 = *Strongly disagree* to 7 = *Strongly agree*. Responses were averaged to create an environmental identity scale (α = 0.92).

Depth of processing was assessed using a 10-item measure adapted from a self-report depth of processing scale (Wolski & Nabi, 2000) on a scale from 1 = *Strongly disagree* to 7 = *Strongly agree*. Self-report measures are increasingly used in dual-processing studies (e.g.; Kidwell, Farmer, & Hardesty, 2013; Lazard & Atkinson, 2015; Yang, Seo, Rickard, & Harrison, 2015) and have good reliability and validity (Reynolds, 1997). A Kaiser-Meyer-Olkin value of 0.919 indicated the data was suitable for factor analysis. Principal axis factoring with Direct Oblimin rotation identified two components (see supplementary information – Table S5). The second factor, however, comprised three reverse scored items which were removed (Barnette, 2000; Woods, 2006). Responses to the remaining seven items, which all loaded > 0.70 on one factor, were averaged to create a depth of processing scale (α = 0.95). An attention check item ("Please select agree to show that you have read and understood this question") was embedded within these items to monitor respondent concentration. Participants that failed the attention check were excluded from the study.

Message recall, consistent with past research (Frey & Eagly, 1993; Smith & Shaffer, 2000), was measured using four free-response questions and three true/false questions. Responses were independently scored by two coders: incorrect answers (0), partially correct answers (0.5) and correct answers (1). Total scores could range from 0 to 14. The average measure for the Intraclass Correlation Coefficient was 0.995, $F(234,234) = 189.22$, $p < .001$, confirming high inter-coder reliability. A total message recall score was generated by averaging the sum of the two coder's scores, with higher scores indicating higher levels of message recall.

[8] To blind participants to the context of the study, participants were also asked to indicate their prior knowledge/involvement in relation to both solar power and genetically modified food.

Policy support. Three items were used to assess participant attitudes towards supporting the implementation of urban stormwater management policy initiatives across different cost points (Kühne & Schemer, 2015). That is, participants were asked if they would support a policy if it had: "no impact on their rates"; "a small impact on their rates ($50 per year)"; and, "if it had a large impact on their rates ($200 per year)" using a 5-point scale (1 = *Not supportive*; 5 = *Definitely supportive*).[9] These items were treated as separate outcome measures in subsequent analyses.

Intentions to discuss was assessed using two items measured on 7-point scales (1 = *Strongly disagree*; 7 = *Strongly agree*. The responses were averaged to create an intentions to discuss score ($r = 0.86$).

Emotions, in line with Fowler (2006), were measured via an open-ended question "How did the image make you feel?" and responses were used as a validation check to confirm the dominant emotion elicited by the image. Participants were scored one (1) if they mentioned feeling a specific discrete emotion or a related synonym (e.g., disgust, yuck, gross) and zero (0) if they did not mention any of the target emotion words.

3.3.2. Analytic strategy

All analyses were planned analyses of interest. The frequency of missing data was less than 5% for all variables. Three univariate outliers (>3 *SD*s) on the environmental identity scale were identified and winsorised (Field, 2013). A number of variables were significantly skewed and six multivariate outliers were detected using Mahalanobis Distance ($p > .001$; Tabachnick & Fidell, 2007). All analyses were conducted with and without transformed variables and as there were no substantive changes to the interpretation of the results, the untransformed data are reported in-text.

3.3.3. Results

3.3.3.1. Manipulation check

Disgust, or a related synonym, was mentioned more frequently than any other discrete emotion in both experimental conditions (see Table 3.1.). There were no differences between the two conditions with regard to the remaining elicited emotions. In the low disgust condition, rather than listing a discrete emotion, participants commonly indicated that they felt "nothing" or provided a descriptive response (e.g., "Rubbish near storage"). However, the image pre-test (refer to the Supplementary Information) confirmed that a sufficient level of disgust (i.e., equal to or greater than the mid-point of the scale) was elicited by both the low and high disgust images. Therefore,

[9] Rates are fees payable to a local government authority who provide local infrastructure and services.

combined with the results of the image pre-tests, the manipulation check confirmed disgust as the dominant (primary) emotion in the disgust conditions.

Table 3.1. Qualitative coding from emotion question for study 1

	Low Disgust Image	High Disgust Image	*p* value
Descriptive response	21	11	$\chi 2$ (1, 153) = 4.12, p = .042
Nothing	12	3	$\chi 2$ (1, 153) = 6.12, p = .013
Disgust	9	39	$\chi 2$ (1, 153) = 26.74, p < .001
Concern[a]	8	2	p = .056
Anger/Annoyed/Bothered	7	9	$\chi 2$ (1, 153) = 0.25, p = .617
Sad	5	6	$\chi 2$ (1, 153) = 0.08, p = .771
Bad/Terrible/Unhappy[a]	4	2	p = .442
Interested/Curious[a]	3	2	p = .681
Ashamed[a]	2	3	p = 1.00
Distress/Upset[a]	1	1	p = 1.00
Disappointed[a]	1	0	p = .497

[a] Fisher's Exact Test was used as ≥ one cell had an expected frequency < five.

3.3.3.2.Focal analyses

Two orthogonal contrast/effect codes were created: the first compared the two experimental conditions to the control condition (X_1: Control = −0.67, Low Disgust = 0.33, High Disgust = 0.33) and the second compared the two experimental conditions to each other (X_2: Control = 0, Low Disgust = −0.50, High Disgust = 0.50). Table S6, in the supplementary information, presents the zero-order correlations, means, and standard deviations. The independent variables (X_1 and X_2) were not correlated with any dependent variables. Environmental identity (the proposed moderator) was positively correlated with depth of processing and all dependent variables. Similarly, all dependent variables were positively associated with each other. To test our overall conceptual model, which proposed that the indirect effect of the experimental conditions on the dependent variables via depth of processing was conditional on the strength of a participant's environmental identity, we used conditional process analyses (Model 7 PROCESS Macro Version 2.15 for SPSS). Bootstrapping of 5000 samples was used, with 95% confidence intervals (Hayes, 2013). Lower and higher levels of the moderator were created by subtracting or adding one standard deviation from the mean. All continuous variables were standardised prior to analysis. The following variables were controlled for: age, gender, education, income, previous knowledge, mood, need for cognition, and involvement.

To provide a formal test for our overall hypothesis, we examined the index of moderated-mediation, which is an interval estimate of the parameter of a function linking the indirect effect to values of the moderator. As predicted, the overall index of moderated mediation for the effect of the

combined X_1 (comparing the combined disgust images to the control condition) on the dependent variable was significant for all five dependent variables: message recall (*Index* = 0.15, *SE* = 0.06, 95% *CI* = [0.0306, 0.2654]); policy support (no cost; *Index* = 0.10, *SE* = 0.05, 95% *CI* = [0.0172, 0.2233]), policy support (minimal cost; *Index* = 0.13, *SE* = 0.06, 95% *CI* = [0.0236, 0.2479]), policy support (maximum cost; *Index* = 0.09, *SE* = 0.05, 95% *CI* = [0.0140, 0.2112]); and intentions to discuss the message with others (*Index* = 0.19, *SE* = 0.08, 95% *CI* = [0.0371, 0.3590]).

The coefficients for all five models are presented in Table 3.2. The results for message recall are presented in full, to illustrate the pattern of effects. As predicted, for participants with lower levels of environmental identity, the indirect effect of X_1 (comparing the combined disgust images to the control condition) evoked lower message recall via lower depth of processing. However, the combined disgust image conditions had no effect on message recall for participants with higher levels of environmental identity.

Table 3.2. Indirect effect of X_1 on the Dependent Variables at Lower and Higher Levels of Environmental Identity for Study 1

	Lower EI			Higher EI		
	IE	*SE*	95% *CI*	*IE*	*SE*	95% *CI*
Recall	−0.16	0.07	−0.3019, −0.0107	0.08	0.06	−0.0315, 0.2217
Policy support (no cost)	−0.11	0.06	−0.2523, −0.0063	0.06	0.05	−0.0218, 0.1707
Policy support (min. cost)	−0.14	0.07	−0.2894, −0.0086	0.07	0.06	−0.0272, 0.1967
Policy support (max. cost)	−0.11	0.06	−0.2411, −0.0053	0.06	0.05	−0.0193, 0.1648
Intentions to discuss	−0.21	0.10	−0.4130, −0.0141	0.11	0.08	−0.0422, 0.2778

Note. EI = Environmental Identity.

The regression coefficients for each path are shown in Figure 3.2. Table S7, in the supplementary information, includes the regression coefficients for all variables. The simple slopes analysis confirmed that at lower levels of environmental identity, the effect of combined disgust images on depth of processing was negative, $b = -0.36$, $p = .020$, but was not significant at higher levels of environmental identify, $b = 0.20$, $p = .190$.

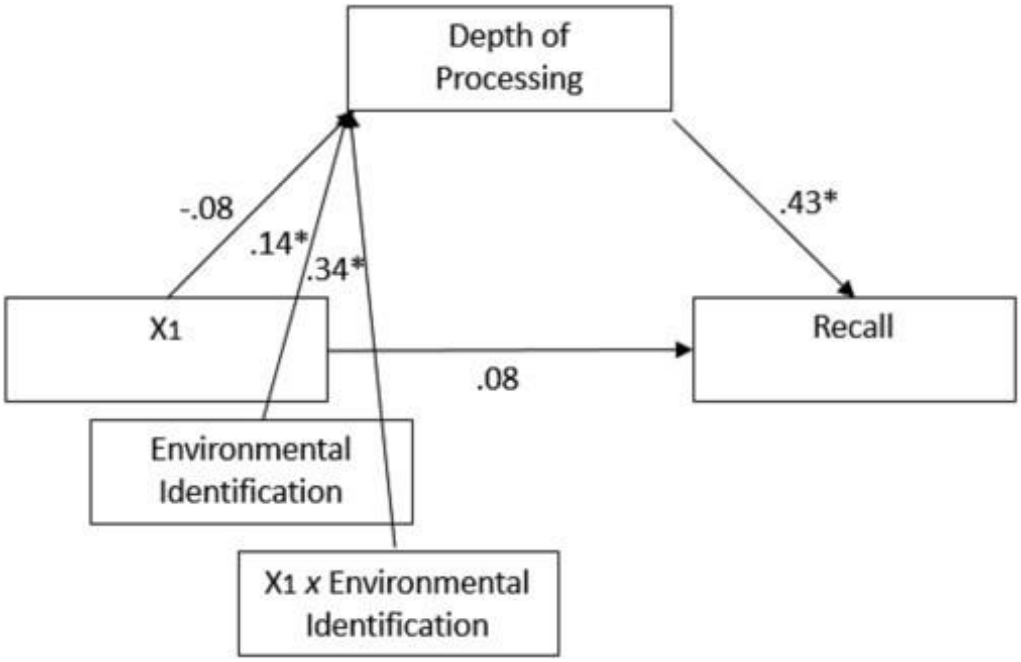

Figure 3.2. Conditional effect of X_1 (Control versus Image Conditions) and Environmental Identity on Recall through Depth of Processing for Study 1.

Note. The regression coefficients for 9 covariates, plus the effect of X_2 (Low Disgust versus High Disgust Image), were not included to reduce visual clutter. *$p < .05$.

The same pattern of indirect effects was evident across all remaining dependent variables (see Table 3.2.). That is, for participants with a lower environmental identity, the relative conditional indirect effect of the combined disgust image conditions, through depth of processing, led to lower levels of policy support (at every price point) and lower intentions to discuss. Table S7, in the supplementary information, lists the regression coefficients for each model.

Contrary to what was predicted, the overall index of moderated mediation for the effect of X_2 (i.e., comparing the low disgust image to the high disgust image) on the dependent variable was not significant for any of the five dependent variables: recall (*Index* = 0.01, *SE* = 0.05, 95% *CI* = [-0.1133, 0.1183]); policy support (no cost; *Index* = 0.00, *SE* = 0.04, 95% *CI* = [-0.0809, 0.0914]); policy support (minimal cost; *Index* = 0.01, *SE* = 0.05, 95% *CI* = [-0.0994, 0.1046]); policy support (maximum cost; *Index* = 0.00, *SE* = 0.04, 95% *CI* = [-0.0758, 0.0821]); and intentions to discuss (*Index* = 0.01, *SE* = 0.08, 95% *CI* = [-0.1402, 0.1545]).

Lastly, the direct effect of the experimental manipulations on each of the dependent variables were not significant (*p*s > 0.272; see supplementary information – Table S7), providing no evidence that the image conditions influenced the dependent variables independent of the mechanism described above, that is, lower depth of processing for those with a low environmental identity.

3.3.4. Discussion

As predicted, the results showed that in comparison to the no image control condition, the two combined disgust image conditions lowered depth of processing for participants with a low environmental identity. This aligns with the ATF, whereby emotions appraised as being highly 'certain' lower depth of processing (Tiedens & Linton, 2001a). Also as predicted, lower levels of depth of processing, in turn, led to poorer recall of the message content, lower support for remedial policy measures regardless of cost, and lower intentions to discuss message content with others. These findings align with past research showing that depth of processing can influence the cognitive, affective, and behavioural engagement of message recipients (Bok & Min, 2013; Meijnders et al., 2001; Nabi, 2003; Petty & Wegener, 1998; Smith & Shaffer, 2000). Our finding that the embedded images had no significant effect on people with a high environmental identity aligns with findings from prior research that communication frames in pro-environmental messages are not as influential for this segment of the community (Roh et al., 2018; Schultz et al., 2017).

Contrary to what was hypothesised, however, there was no significant difference between the two disgust image conditions in terms of their effect on depth of processing. That is, there was no evidence to suggest that a "more" disgusting image strengthens the negative effect of the emotion on depth of processing, and therefore, message/policy engagement. However, a potential alternative explanation is that it is not the emotion elicited by the image driving the effect but rather something specific to the images themselves. A second study was therefore undertaken to address this issue.

The second study used a different 'disgusting' image to assess the generalisability of the Study 1 findings and added an experimental condition that included an image that elicited a different discrete emotion (i.e., sadness). Study 2, therefore, extends the extant literature by exploring the effects of another commonly elicited emotion in pro-environmental campaigns – that of sadness. Sadness is associated with the cognitive appraisal of feeling 'uncertain' (Bodenhausen et al., 1994) and is therefore hypothesised to motivate a higher level of message processing in comparison to disgust. We also included a new variable, disgust sensitivity, to control for any potential effects of participants having a strong disposition to experiencing this emotion. Lastly, we extended our manipulation check, which assessed the primary/dominant emotion-elicited, to include the control condition, as this was missing in our first experiment. This allowed us to check whether the factsheet, in and of itself, elicited emotion.

3.4. Study 2

3.4.1. Method

The study included one manipulated independent variable with three levels (Image: no image, disgust image, sad image), in a between-subjects design using the same written factsheet as Study 1.

3.4.1.1.Participants

The data were collected using a paid on-line research panel. Quotas were used to ensure age and gender were reasonably balanced. Only homeowners residing in Melbourne, Australia were recruited. A total of 516 respondents started the survey, of whom 31 failed to complete.[10] A further 96 respondents were excluded from the study: four failed to see any of the conditions due to a technical problem with the online platform; 14 indicated that English was not their primary language; and 79 failed the attention check item.[11] This left 388 participants. For all socio-demographic data see Table S8 in the supplementary information. Participants were randomly allocated to the control ($n = 137$), disgust image ($n = 125$) or sad image ($n = 126$) conditions. Chi-square analyses indicated only one significant difference in the sociodemographic variables across conditions. As the distribution of renters/apartment dwellers was not even across the conditions, this variable was controlled for in all further analyses.

3.4.1.2.Procedure

After consenting to participate and answering basic demographic and control questions, participants were randomly assigned to one of three versions of the factsheet about sustainable urban stormwater management. Again, only the embedded image varied between the conditions. For participants assigned to the disgust image condition, the image was of a stormwater litter trap and in the sad image condition, the image depicted a turtle ingesting a blue plastic bag (see the supplementary information – Figure S2). The two images were pre-tested on an Australian community sample sourced from an online platform (www.microworkers.com; $N = 56$, $M_{age} = 29.86$ years, $SD_{age} = 10.18$ years, 66.10% male) to confirm that the dominant emotions elicited were disgust and sadness respectively (see the supplementary information). The control condition

[10] Twenty-three participants exited the survey prior to being allocated to a condition. The remaining incompletes were: one in the disgust condition, four in the control condition and two in the sad condition.

[11] There were no significant difference across conditions, $\chi 2$ (2, $N = 485$) = 1.17, $p = .556$.

factsheet had no image. After reading the factsheet, participants answered questions measuring the same variables as in Study 1 with two exceptions. Two additional variables were added, as outlined below and the Need for Cognition and PANAS measures were not included given that their inclusion in the models tested in Study 1 did not substantively change the interpretation of the results.

3.4.1.3.Measures

The following variables were identical to those in the first study: previous knowledge about focal issue; environmental identity ($\alpha = 0.94$); depth of processing ($\alpha = 0.95$); message recall (Intraclass Correlation Coefficient was 0.948, $F(387,387) = 19.52$, $p < .001$); policy support at no cost, minimal cost, and with maximum cost; and intentions to discuss message content with others ($\alpha = 0.96$). Means and standard deviations are provided in Table S9 available in the supplementary information.

A measure of disgust sensitivity was included to control for the influence of this individual difference characteristic on the manipulation and was assessed using three items on a scale from 1 = *Strongly disagree* to 7 = *Strongly agree* ($\alpha = 0.88$). The manipulation check on emotions elicited was adapted to include the control condition by rewording the open-ended item to read: "Thinking back to when you first saw the above factsheet, please indicate how it made you feel?".

3.4.2. Analytic strategy

Again, all analyses were planned analyses of interest. The frequency of missing data was less than 5% for all variables. Three univariate outliers on the environmental identity scale were identified and winsorised (Field, 2013). As a number of variables were significantly skewed, all analysis were conducted with and without transformed variables with no substantive changes to the interpretation of the results. Therefore, untransformed data are reported here.

3.4.3. Results

3.4.3.1.Manipulation check

Disgust, or a related synonym, was the mostly frequently mentioned emotion in the disgust image condition, while sadness or a related synonym was the most frequently mentioned in the sad image condition (see Table 3.3.). Interest and other positive words (e.g., "good" and "happy") were mentioned more frequently in the control condition in comparison to the two experimental conditions. There were no significant differences between the conditions for any of the other reported discrete emotions.

Table 3.3. Qualitative coding from manipulation check for study 2

	No Image	Disgust Image	Sad Image	*p* value
Disgust	2	44	7	$\chi 2$ (2, $N = 382$) = 60.31, $p < .001$
Sad/Upset	4	14	53	$\chi 2$ (2, $N = 382$) = 72.83, $p < .001$
Disappointed[a]	0	4	2	$p = .077$
Anger	5	8	5	$\chi 2$ (2, $N = 382$) = 0.61, $p = .739$
Fear[a]	1	0	3	$p = .101$
Distress[a]	1	0	3	$p = .101$
Shock[a]	3	4	1	$p = .408$
Ashamed/Guilty	1	5	4	$\chi 2$ (2, $N = 382$) = 2.75, $p = .253$
Bad/Unhappy	1	7	7	$\chi 2$ (2, $N = 382$) = 4.56, $p = .102$
Concern/Worried	5	6	9	$\chi 2$ (2, $N = 382$) = 1.52, $p = .467$
Confused[a]	3	0	2	$p = .095$
Informed[a]	5	3	2	$p = .449$
Interested	26	9	9	$\chi 2$ (2, $N = 382$) = 17.30, $p < .001$
Good/Okay/Fine	12	3	6	$\chi 2$ (2, $N = 382$) = 7.54, $p = .023$
Happy/Pleased/Glad[a]	6	0	0	$p = .001$
Hopeful/Encouraged[a]	5	1	0	$p = .010$
Positive[a]	3	2	1	$p = .293$
Fantastic/Excited[a]	2	0	1	$p = .459$
Nothing	15	9	7	$\chi 2$ (2, $N = 382$) = 4.43, $p = .109$
Description	19	17	10	$\chi 2$ (2, $N = 382$) = 3.40, $p = .183$

[a] Linear by Linear Association reported as more than two cells had an expected cell count < 5.

3.4.3.2.Focal analyses

Two effect codes were created: the first compared the disgusting image condition to the control condition and the sad image condition (X_1: Control = −0.33, Sad Image = −0.33, Disgust Image = 0.67) and the second compared the sad image condition to the control condition (X_2: Disgust Image = 0, Control = −0.50, Sad Image = 0.50).[12] Table S9, in the supplementary

[12] If we compare the two experimental conditions to the control condition (i.e., X_1: Control = −0.67, Disgust = 0.33, Sadness = 0.33) paired with a comparison of the two experimental conditions to each other (e.g., X_2: Control = 0, Disgust = −0.50, Sadness = 0.50), the overall index of moderated mediation for X_1 is non-significant for all five dependent variables (refer to Table S11 in the Supplementary Information) but is significant for X_2. The non-significant finding for X_1 is in line with our theoretical argument that sadness and disgust will have opposing effects on depth of

information, presents the zero-order correlations. Similar patterns of correlations amongst variables were found in Study 2 as in Study 1.

A similar analytic approach was taken in Study 2 as in Study 1 with analyses controlling for age, gender, education, income, previous knowledge, housing type and disgust sensitivity. The overall index of moderated mediation for X_1 (comparing the combined control and sad image conditions to the disgust image condition) on the dependent variable was significant for all five dependent variables: recall (*Index* = 0.08, *SE* = 0.04, 95% *CI* = [0.0014, 0.1678]); policy support (no cost; *Index* = 0.09, *SE* = 0.05, 95% *CI* = [0.0019, 0.1958]), policy support (minimal cost; *Index* = 0.07, *SE* = 0.04, 95% *CI* = [0.0007, 0.1536]), policy support (maximum cost; *Index* = 0.05, *SE* = 0.03, 95% *CI* = [0.0003, 0.1021]); and intentions to discuss (*Index* = 0.11, *SE* = 0.06, 95% *CI* = [0.0014, 0.2310]).

The coefficients for all five models are presented in Table 3.4. The results for message recall are presented in full, to illustrate the pattern of effects. For participants with lower levels of environmental identity, the disgust image evoked lower message recall via lower depth of processing. In contrast, the disgust image had no effect on message recall for participants with higher environmental identity.

Table 3.4. Indirect effect of X_1 on the Dependent Variables at Lower and Higher Levels of Environmental Identity for Study 2

	Lower EI			Higher EI		
	IE	*SE*	95% *CI*	*IE*	*SE*	95% *CI*
Recall	−0.13	0.07	−0.2812, −0.0075	0.04	0.05	−0.0508, 0.1479
Policy support (no cost)	−0.15	0.08	−0.3294. −0.0070	0.05	0.06	−0.0545, 0.1727
Policy support (min. cost)	−0.12	0.06	−0.2555, −0.0041	0.04	0.05	−0.0480, 0.1384
Policy support (max. cost)	−0.07	0.04	−0.1643, −0.0011	0.03	0.03	−0.0272, 0.0910
Intentions to discuss	−0.19	0.10	−0.3835, −0.0072	0.07	0.07	−0.0719, 0.2084

Note. EI = Environmental Identity.

The regression coefficients for each path are shown in Figure 3.3. The simple slopes analysis confirmed that at lower levels of environmental identity, the effect of disgust images on

processing and the finding from the focal analyses described above which identified a non-significant difference between the control and sad image conditions.

depth of processing was negative, $b = -0.31$, $p = .020$, but was not significant at higher levels of environmental identity, $b = 0.11$, $p = .402$.

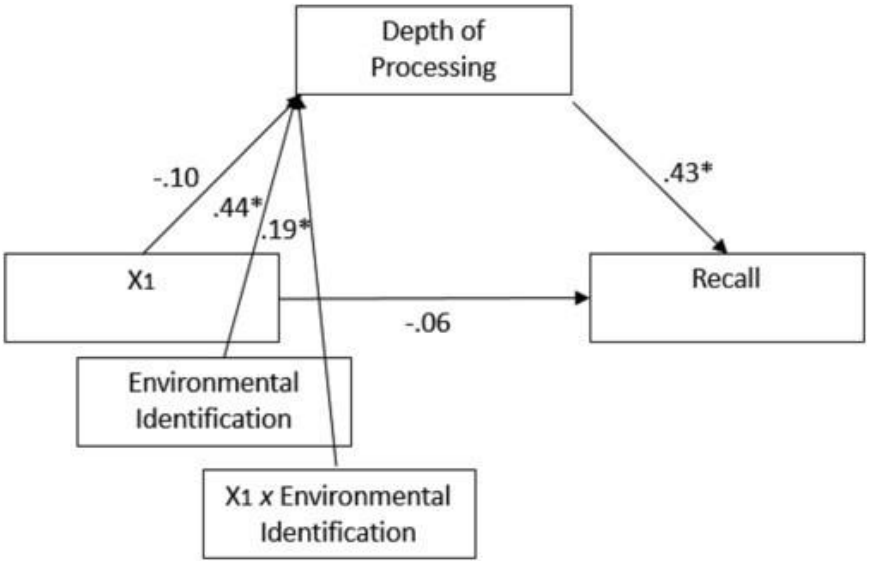

Figure 3.3. Conditional effect of X_1 (Control and Sad Image versus Disgust Image) and Environmental Identity on Recall through Depth of Processing for Study 2.
Note. The regression coefficients for 7 covariates, plus the effect of X_2 (Sad Image versus Control), were not included to reduce visual clutter.*$p < .05$.

The same pattern of indirect effects emerged across all remaining dependent variables (see Table 3.4). That is, for participants with lower levels of environmental identity, the relative conditional indirect effect of the disgust image condition, through depth of processing, led to lower policy support (regardless of cost) and intentions to discuss. Table S10, in the supplementary information, lists the regression coefficients for each regression.

Contrary to what was predicted, the overall index of moderated mediation for the effect of X_2 (comparing the sad image condition to the control condition) on the dependent variable was not significant for any of the five dependent variables: recall (*Index* = −0.05, *SE* = 0.05, 95% CI = [-0.1590, 0.0454]); policy support (no cost; *Index* = −0.06, *SE* = 0.06, 95% *CI* = [-0.1730, 0.0506]); policy support (minimal cost; *Index* = −0.05, *SE* = 0.05, 95% *CI* = [-0.1477, 0.0391]); policy support (maximum cost; *Index* = −0.03, *SE* = 0.03, 95% *CI* = [-0.0246, 0.0992,]); and intentions to discuss (*Index* = −0.08, *SE* = 0.07, 95% *CI* = [-0.2174, 0.0619]).

Lastly, the direct effect of the experimental manipulations on each of the dependent variables were not significant (*p*s > 0.081; see supplementary information – Table S10), providing no evidence that the image conditions influenced the dependent variables independent of the mechanism described above, that is, lower depth of processing for those with low levels of environmental identity.

3.4.4. Discussion

The findings from Study 2 confirmed those of Study 1; the disgusting image decreased participants' processing of the message content for those with lower environmental identity, and this in turn, resulted in poorer cognitive, affective, and behavioural engagement with the message content. Given the use of different disgusting images across the two studies, the findings suggest that integral disgust, as elicited by an image, is driving the effects, rather than something specific to the image used in Study 1.

Contrary to what was expected, the sad image did not increase participants' depth of processing in comparison to the control condition. This finding does not align with past research which has demonstrated that sadness is associated with more in-depth processing (Bodenhausen et al., 1994; Tiedens & Linton, 2001a). However, the results of our manipulation check suggest that the plain white page with black text and no image used in the control condition (see Figure S3 supplementary materials) may not have served as a neutral baseline condition but rather elicited positive emotions. Specifically, responses to the manipulation check item ("How did you feel when you first saw the factsheet?") indicated a large proportion of the control condition participants reported being "interested" or feeling some other positive emotion (e.g., "okay", "happy", "hopeful", "good" and "positive"), which in turn may have influenced their depth of processing. Within the small body of research exploring the effect of discrete, integral positive emotions on depth of processing, mixed results have been reported (Lerner, Li, Valdesolo, & Kassam, 2015). Griskevicius, Shiota, and Neufeld (2010), for example, tested six incidental positive emotions and found differential effects; enthusiasm, amusement, and attachment love appeared to enhance peripheral processing, while awe and nurturant love lead to more central processing. Conversely, contentment was not significantly different from a neutral control condition. That some discrete positive emotions lead to more central processing aligns with the broaden- and-build theory of positive emotion (Fredrickson, 2001). Similar to the ATF of emotion, the broaden-and-build hypothesis argues that positive emotions can have differential effects on cognition and behaviour (Fredrickson & Branigan, 2005; Fredrickson, 2001). It is therefore possible that the most commonly elicited discrete emotion in our control condition, interest, may have promoted central processing, thus reducing any differences with the sad image condition.

3.5. General discussion

We postulated that the addition of images to text-based communication can change the way people process messages, primarily through the emotions elicited by embedded imagery. Dual-processing research has largely ignored the role of integral emotions and the potential for still images (i.e., photographs) to evoke emotions. We addressed these issues by examining the effects

of two integral emotions elicited by images on message processing as well as overall cognitive, affective, and behavioural engagement with the focal topic of sustainable urban stormwater management.

In line with our prediction, the extent to which an image-evoked emotion influences message processing is moderated by the strength of an individual's environmental identity. Specifically, a disgust evoking image embedded in a pro-environmental message does not affect the depth to which individuals with a strong environmental identity process the contents of the message, as their identity already drives them to pay attention. As such, they are less likely to be influenced by peripheral cues such image-evoked emotions (Petty & Wegener, 1998). Conversely, when environmental identity is low, the presence of a disgust-evoking image can lead to shallower processing which, in turn, lowers message engagement. In this latter context, individuals recall less of the message content, are less willing to support sustainable stormwater management initiatives, and are less willing to discuss the message content with others around them. This is problematic given these individuals are often the target of pro-environmental campaigns. Our finding that there was no difference between the low and high disgust conditions in Study 1 suggests that any level of disgust can generate these effects.

The findings from Study 2 were unexpected in that the image eliciting sadness did not significantly increase message or topic engagement beyond the image-free control message. This finding suggests that a novel, well-written factsheet may be effective in engaging viewers without the need for additional imagery. However, future research is needed to rule out the potential influence of sadness-inducing imagery, since our manipulation check suggests our control condition did not act as a neutral baseline. Indeed, the control condition elicited interest among participants, perhaps because of the novel topic. It is feasible that this positive state increased message processing which washed out the effects of the sadness condition.

3.5.1. Limitations and future research

Future research is also needed to examine whether the current findings translate to pro-environmental contexts beyond sustainable urban stormwater management, and with message formats and images beyond those studied here. Furthermore, it is important to assess whether the findings translate to other discrete emotions. For example, fear, like sadness, is characterized by the ATF as an “uncertain” emotion and is predicted to increase depth of processing. Given the ubiquity of fear appeals in pro-environmental communication (O'Neill & Nicholson-Cole, 2009), research investigating the effect of fear-eliciting images would be advantageous. A further limitation of the study was that we did not measure actual behaviour. While previous studies have shown evidence for a positive relationship between pro-environmental attitudes, intentions and behaviour (Ajzen & Fishbein, 2005; Kormos & Gifford, 2014), research is needed to see whether such effects translate

to actual behaviour. While the findings were in line with our hypotheses drawn from the ATF, future research should investigate alternative explanations such as evolutionary perspectives (e.g., Griskevicius et al., 2010) or perceptual fluency perspectives (e.g., Tangen et al., 2011).

Lastly, while we interpret the findings above as highlighting the difference between the disgust and control/sadness conditions, it should be noted that if the combined disgust and sadness conditions are compared to the control condition, the differences are not significant. This is presumably because of the non-significant difference between the sad image and control condition. Future research should refine the manipulations as much as possible and/or measure attributes of each prime that could lead to different indirect effects in a suppression model.

3.5.2. Conclusion

Our research demonstrates that the selection of images used to accompany written messages matters. In the context of messages about sustainable urban stormwater management, embedding disgust-inducing images within communication messages had a detrimental effect for those people who did not have a strong environmental identity because it reduced their message processing and subsequent engagement with the issue. The results serve as a warning to practitioners selecting images in pro-environmental contexts, as some can serve to disengage the very people the campaigns are targeting (i.e., people with less involvement with environmental issues).

The findings from these studies contribute to the relatively new area of research exploring the role of images and emotions in engaging communities with pro-environmental communication (e.g., Chapman et al., 2016; O'Neill, 2013; O'Neill & Nicholson-Cole, 2009). A further contribution is that the findings show that the discrete integral emotion of disgust influences depth of processing. To the best of our knowledge, this is the first research to demonstrate that disgust-inducing images aligned to message content can negatively influence cognitive, affective, and behavioural engagement with a pro-environmental communication. We hope that these findings will encourage further research into the potential effects of other commonly used image-induced emotions on message processing and issue engagement.

3.5.3. Conflicts of interest

None.

3.5.4. Acknowledgements

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3.6. Supplementary data

Table S1 Individual Characteristics (Standard Deviations or Percentages in brackets) for Study 1

	Control	Low Disgust	High Disgust	Total	
Number of participants	80 (34.04)	76 (32.34)	79 (33.62)	235	
Age (Years)	52.47 (16.35)	53.79 (16.39)	51.11 (16.17)	52.44 (16.67)	$F(2, 232) = 0.51$, $p = .599$
Gender					
Male	29 (36.25)	34 (44.70)	36 (46.20)	99 (42.30)	χ^2 (2, $N = 234$) = 1.86, $p = .395$
Female	51 (63.75)	42 (55.30)	42 (53.80)	135 (57.70)	
State (%)					
Qld	12 (15.00)	10 (13.20)	13 (16.50)	35 (14.90)	χ^2 (6, $N = 235$) = 4.34, $p = .565$
NSW	22 (27.50)	31 (40.80)	25 (31.60)	78 (33.20)	
VIC	38 (47.50)	32 (42.10)	36 (45.60)	106 (45.10)	
WA	8 (10.00)	3 (3.90)	5 (6.30)	16 (6.80)	
Home ownership					
Rented	17 (21.50)	16 (21.10)	20 (25.30)	53 (22.60)	χ^2 (2, $N = 234$) = 0.49, $p = .783$
Owned	62 (78.50)	60 (78.90)	59 (74.70)	181 (77.40)	
Home Type (%)					
Apartment	27 (33.75)	22 (28.90)	16 (20.30)	65 (27.70)	χ^2 (2, $N = 235$) = 3.71, $p = .156$
House	53 (66.25)	52 (71.1)	63 (79.70)	170 (72.30)	
Education (%)					
School/Trade	40 (50.00)	46 (60.50)	46 (58.20)	132 (56.20)	χ^2 (4, $N = 235$) = 7.83, $p = .098$
Undergraduate	29 (36.25)	17 (22.40)	15 (19.00)	61 (26.00)	
Postgraduate	11 (13.75)	13 (17.10)	18 (22.80)	42 (17.90)	
Income					

	Control	Low Disgust	High Disgust	Total	
< AUD$49,999	29 (37.20)	30 (40.00)	30 (40.00)	89 (39.04)	χ^2 (4, N = 228) = 1.57, p = .814
AUD$50-99,999	30 (38.50)	28 (37.30)	23 (30.70)	81 (35.53)	
> AUD$100,000	19 (24.40)	17 (22.70)	22 (37.90)	58 (25.44)	

Study 1 image pilot test

Three pairs of images, all contextually relevant to the topic, were tested to assess whether they elicited the target discrete emotion of disgust at low or high levels. Each pair consisted of an unaltered image chosen to elicit low levels of disgust and the same image digitally manipulated to elicit higher levels of disgust. For example, one pair comprised an image of a stormwater drain in an urban street with rubbish bags beside it and the same image digitally manipulated to elicit higher levels of disgust through the addition of more rubbish (see Figure S1, a and b). The next pair comprised an unaltered image of a stormwater outlet at a beach and a digitally altered image that included additional rubbish in order to elicit higher levels of disgust (see Figure S1, c and d). In the final pair, an image of a rural creek was altered to make the water more turbid with more visible contamination (see Figure S1, e and f). The pre-test was conducted to ensure that the final pair of images used in the focal experiment elicited the target emotion of disgust and that the image in the low disgust condition elicited significantly less disgust than the digitally manipulated image in the high disgust condition.

(a)  (b) 

(c)  (d) 

(e)  (f) 

Figure S1. Image pairs used for pre-testing

The image pre-test was conducted in March 2016 using first-year psychology students from the University of Queensland (N = 51, 68.63% Female, M_{age} = 23.57 years, SD_{age} = 4.55). Participants were recruited via the university's first year research participation program and were granted course credit for their participation. The survey was hosted on the Qualtrics platform. A 2 (Disgust: High, Low) x 3 (Image: Stormwater Drain, Beach, River) mixed design was used, with image as the repeated factor. Participants were asked to indicate "To what extent did viewing the image make you feel the following emotions" on scales from 1 = *Not at all* to 5 = *Extremely*. Five positive emotions (inspiration, hope, serenity, joy, pride) and five negative emotions (fear, anger, sadness, distress and disgust) were presented to participants and were randomised to reduce order effects. Each discrete emotion was a single-item measure, with higher scores indicating higher levels of the respective emotion.

As can be seen from Table S2, with the exception of the river images, the median score[13] for the target emotion of disgust was at the midpoint in the low disgust condition and well above the mid-point in the high disgust condition. The river images were excluded as they failed to elicit the target emotion of disgust as evidenced by no significant differences between the two images. Due to severe departures from normality, a series of Mann-Whitney U tests assessed the degree to which the image in the high disgust condition elicited significantly higher levels of each of the discrete emotions when compared to the low disgust image.

[13] Due to high positive skew, the median scores are reported.

Table S2. Median Emotion Scores for Image Pairs

	Stormwater Drain			Beach			River		
	Low *n* = 26	High *n* = 25	*p*	Low *n* = 26	High *n* = 25	*p*	Low *n* = 26	High *n* = 25	*p*
Disgust	2.50	4.50	.002	2.50	5.00	.008	1.00	1.00	.254
Distress	1.00	2.50	.010	1.50	2.50	.001	1.00	1.00	.478
Angry	2.00	3.00	.035	1.00	3.00	.002	1.00	1.00	.851
Sad	2.50	3.00	.127	3.00	2.00	.470	1.00	1.00	.110
Fearful	1.00	2.00	.092	1.00	2.00	.266	1.00	1.00	.943
Joy	1.00	1.00	.070[a]	1.00	1.00	.261	3.00	2.00	.176
Serene	1.00	1.00	.013[a]	1.00	1.00	.025[a]	4.00	4.00	.116
Hopeful	1.00	1.00	.840	1.00	1.00	.839	3.00	1.00	.101
Proud	1.00	1.00	.380	1.00	1.00	.261	2.50	1.00	.100
Inspired	1.00	1.00	.575	1.00	1.50	.378	3.00	1.00	.026

[a]Significant Mann-Whitney tests with equal medians (see UCLA: Statistical Consulting Group, n.d.) indicate that although on average the targets did not differ on this attribute, at the extremes, the high disgust condition was ranked less joyful and serene than the low disgust condition for the stormwater drain context, and less serene for the beach context.

With regard to both the stormwater drain and beach image pairs, the images in the high disgust condition elicited significantly higher levels of disgust, distress, and anger when compared to the low disgust condition. However, the scores for sadness and fear were not significantly different. Although the pre-test results indicated that the images elicited emotions other than the target emotion of disgust, such as anger and sadness, this is not uncommon for emotion inductions using either text or visuals images (Dillard & Nabi, 2006; Gross & Levenson, 1995; Nabi, 1998, 2002). It is therefore recommended to confirm the dominant or primary emotion being elicited as "even in blends, it is common for one emotion to dominate perception, information processing and behaviour, even when other emotions are aroused" (Nabi, 2002, p. 214). Therefore, to confirm that disgust was the most dominant emotion elicited by each image, a series of related-samples Wilcoxon Signed Rank tests were performed with a Bonferroni adjusted $\alpha = .013$. With regard to the beach image in the low disgust condition, the results confirmed that the median score for disgust was significantly higher than anger ($p = .008$) and fear ($p = .002$) but with the Bonferroni adjustment, not significantly different from distress ($p = .028$) or sadness ($p = .812$). With regard to the beach image in the high disgust condition, the median score for disgust was significantly higher than distress ($p = .010$), fear ($p = .001$) and sadness ($p = .019$) but not anger ($p = .035$). These tests were repeated for the stormwater drain images. In the low disgust condition, the median score for disgust was significantly higher than the median score for distress ($p = .001$), anger ($p = .003$) and

fear ($p < .001$) but not sadness ($p = .186$). In the high disgust condition, disgust was significantly higher than all other negative emotions ($ps < .005$).

Taken together, the findings from the related-samples Wilcoxon Signed Rank tests confirmed that the dominant or primary emotion elicited by the stormwater image was the target discrete emotion of disgust. As such, this image pair was used for the focal experiment. The fact that disgust was not elicited at a higher level than sadness in the low disgust condition was not considered problematic because there were no differences between the low disgust and high disgust image with regard to the emotion of sadness. Therefore, any differences between the conditions could be attributed to the feeling of disgust.

Study 2 image pilot test

A second pilot test was conducted for Study 2. This second study aimed to replicate the results of Study 1 using a different image designed to elicit the discrete emotion of disgust (a litter trap), and to assess the influence of another discrete emotion, that of sadness, as a comparison condition (in addition to a control condition which included a message but no embedded image). The pre-test to Study 2 was therefore designed to confirm that the image selected to elicit disgust (an image of a litter trap on a river) and an image selected to elicit high levels of sadness (an image of a turtle ingesting a plastic bag) elicited the target emotions (see Figure S2).

Figure S2. Litter trap image (left) and turtle image (right)

The Study 2 pre-test was conducted in January 2017 using an Australian community sample ($N = 56$, 66.10% Male, $M_{age} = 29.86$ years, $SD_{age} = 10.18$). Participants were recruited from the online platform www.microworkers.com.au and paid US$3.00 for their participation. The survey was hosted on the Qualtrics platform. A 2-level within-subjects design was used, whereby each participant was asked to rate both the disgusting and sad images. Unlike the image pre-test for Study 1, emotion was assessed using two measures. The first measure was the same as for the image pre-test for Study 1, with the exception that participants recorded their emotional reactions to the image on a 5-point Likert scale (1 = *Not at all*, 5 = *A great deal*) in terms of 11 rather than 10 discrete emotions. The additional emotion was that of indifference. For the second measure,

participants were asked to indicate “How did the image make you feel?” Based on a measure used by Fowler (2006), this open-ended question served as a validation check to confirm the dominant or primary emotion elicited by the presented image. The open-ended responses were coded one (1) for participants who mentioned feeling a discrete emotion or a related synonym and zero (0) for those who did not to mention any of the target words.

As can be seen in Table S3, the mean score for the target emotion of disgust was above the midpoint for the litter trap image. Similarly, the mean score for the target emotion of sadness was above the mid-point in the turtle image condition. Due to marked departures from normality for the positive-valence emotions, a series of Wilcoxon signed-ranked tests were undertaken with emotion as the dependent variable and the image condition as the within-subjects variable. The tests revealed no significant differences between the images in terms of the degree of joy, serenity and indifference elicited. Despite the median scores being identical, the image of the litter trap was perceived to be more hopeful, to elicit more pride, and more inspiration than the image of the turtle with a plastic bag in its mouth.

For the negative-valence items, a series of paired *t*-tests were performed as there were no violations of normality assumptions. With regard to the target emotion of sadness for the turtle image, participants were more saddened, but also more fearful, after viewing the turtle image (target sad image) compared to the litter trap (target disgust image). With regard to the target emotion of disgust for the litter trap image, participants were marginally more disgusted, but also more distressed by the litter trap image compared to the turtle image. There were no differences between the conditions in terms of the amount of anger elicited.

With regard to the dominant negative emotion elicited by each image, a second series of paired *t*-tests (Bonferroni corrected $\alpha = .013$) indicated that the litter trap image elicited significantly higher levels of disgust compared to the discrete emotions of sadness, distress, and fear, $ps < .003$. There was only marginal evidence of a difference between disgust and anger ($p = .016$). The turtle image elicited significantly higher levels of sadness compared to fear and distress, $ps < .001$, but sadness was not significantly higher than anger or disgust, $ps > .057$.

Table S3. Median/Mean scores for the Quantitative Emotion Scales for Image Pre-test for Study 2

	Litter Trap Image	Turtle Image	*p*
Joy[a]	1.00	1.00	.399
Serenity[a]	1.00	1.00	.121
Hope[a]	1.00	1.00	.030[b]
Pride[a]	1.00	1.00	.018[b]
Inspiration[a]	1.00	1.00	.020[b]
Indifference[a]	1.00	1.00	.616
Disgust	3.71 (1.36)	3.30 (1.46)	.068
Distress	2.70 (1.35)	3.04 (1.48)	.071
Anger	3.35 (1.41)	3.38 (1.50)	.673
Fear	2.27 (1.21)	2.59 (2.27)	.040
Sadness	3.14 (1.33)	3.57 (1.33)	.013

[a] Due to marked departures from normality, the median score has been provided and mean differences were assessed using the Wilcoxon Signed-Ranked test.
[b] Significant Wilcoxon Signed-Ranked tests with equal medians indicate that although on average the targets did not differ on this attribute, at the extremes, the turtle condition was ranked lower for hope, pride and inspiration in comparison to the litter trap condition.

Significant differences with regard to the target dominant emotion of disgust and sadness were not clear when considering the quantitative data. However, the qualitative data (see Table S4), which is a more accurate measure of the primary emotion elicited (Fowler, 2006), clearly indicated that sadness was nominated more frequently than any other emotion in the turtle image condition (n = 32); as well as in comparison to the litter trap (disgust) image (n = 14). While no differences were evident between the quantitive scores for sadness, disgust and distress within the tutle image condition, very few participants nominated disgust (n = 3) or distress (n = 0) as the dominant emotion.

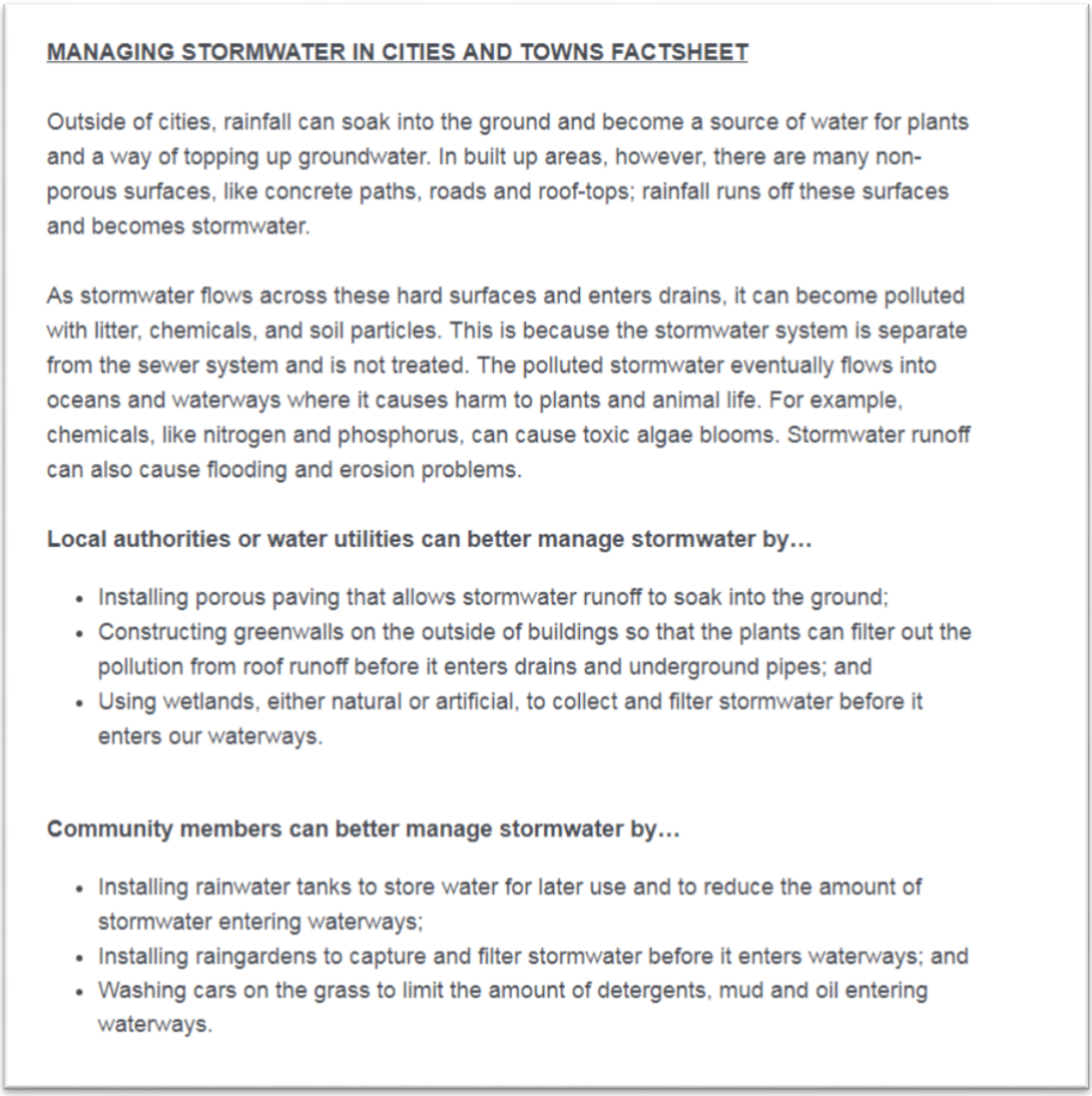
Table S4 Qualitative Coding from Emotion Question for Image Pre-test for Study 2

	Litter Trap Image	Turtle Image	*p*
Certain-Appraisal			
Disgust	18	3	χ^2 (1, 107) = 11.67, $p < .001$
Angry[a]	12	8	-
General Positive Affect[a]	8	0	-
Total	38	11	χ^2 (1, 107) = 21.37, $p < .001$
Uncertain-Appraisal			
Sadness	14	32	χ^2 (1, 107) = 15.52, $p < .001$
General Negative Affect[a]	2	3	-
Fear[a]	1	2	-
Worry[a]	3	4	-
Total	20	41	χ^2 (1, 107) = 21.74, $p < .001$
Interest[b]	1	1	$p = 1.000$
No emotion[b]	1	1	$p = 1.000$
Descriptive response[b]	1	5	$p = .101$

[a] These items were collapsed into categories based on certainty valence.
[b] Fisher's Exact Test was used as ≥ one cell had an expected frequency < five.

As expected, disgust was the most frequently mentioned discrete emotion in relation to the litter trap image (target emotion disgust, $n = 18$), and signficantly more than in the turtle image (target emotion sadness, $n = 3$). As discussed below, participants did nominate other discrete emotions in response to both the litter trap and turtle images, yet these largely fell in line with hypothesised appraisal differences. That is, once all emotions associated with certain-appraisals and all emotions associated with uncertain-appraisals were collapsed, it was clear that participants felt more emotions associated with 'certainty' in response to the litter trap image designed to elicit disgust (which is hypothesised to have a negative effect on depth of processing). Conversely, participants felt more emotions associated with 'uncertainty' when viewing the turtle image designed to elicit sadness (which is hypothesised to have a positive effect on depth of processing). We consider that real-world images of damaged, disgusting environments do generally elicit associated emotions in

many participants, such as anger, rather than a singular response. Accordingly, the stimuli were deemed suitable for further testing in Study 2.



MANAGING STORMWATER IN CITIES AND TOWNS FACTSHEET

Outside of cities, rainfall can soak into the ground and become a source of water for plants and a way of topping up groundwater. In built up areas, however, there are many non-porous surfaces, like concrete paths, roads and roof-tops; rainfall runs off these surfaces and becomes stormwater.

As stormwater flows across these hard surfaces and enters drains, it can become polluted with litter, chemicals, and soil particles. This is because the stormwater system is separate from the sewer system and is not treated. The polluted stormwater eventually flows into oceans and waterways where it causes harm to plants and animal life. For example, chemicals, like nitrogen and phosphorus, can cause toxic algae blooms. Stormwater runoff can also cause flooding and erosion problems.

Local authorities or water utilities can better manage stormwater by…

- Installing porous paving that allows stormwater runoff to soak into the ground;
- Constructing greenwalls on the outside of buildings so that the plants can filter out the pollution from roof runoff before it enters drains and underground pipes; and
- Using wetlands, either natural or artificial, to collect and filter stormwater before it enters our waterways.

Community members can better manage stormwater by…

- Installing rainwater tanks to store water for later use and to reduce the amount of stormwater entering waterways;
- Installing raingardens to capture and filter stormwater before it enters waterways; and
- Washing cars on the grass to limit the amount of detergents, mud and oil entering waterways.

Figure S3. Managing stormwater in cities and towns factsheet.

Table S5. Factor Loadings for Principal Axis Factoring with Direct Oblimin Rotation of Depth of Processing Scale

	Factor	
	1	2
My mind kept wandering as I was reading the factsheet		0.87
Thoughts about other things kept popping into my mind as I read the factsheet		0.84
I was easily distracted whilst reading the content of the factsheet		0.67
I was able to focus on the content of the factsheet	0.74	
I concentrated on the content of the factsheet	0.77	
I paid close attention to each point that was made in the factsheet	0.78	
I was interested in what the factsheet had to say	0.90	
I found the factsheet was thought provoking	0.84	
I was motivated to read the factsheet	0.91	
The content of the factsheet made me stop and think	0.83	
Total variance explained (%)	64.90	13.44

Table S6. Inter-correlations for all Measures for Study 1

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1.	Age	-	.10	.04	.22**	.08	-.19**	.17*	-.11	.01	-.31**	-.25**	-.22**	-.15*	-.06	-.02	-.10	.00	.07
2.	Gender (0 = Male, 1 = Female)		-	.02	-.06	-.03	-.03	.14*	-.16*	.28**	.05	.15*	.04	.03	.04	.04	.12	-.09	-.01
3.	Education (1-5)			-	.23**	.14*	.08	.01	-.01	.02	-.10	.13	.11	.08	.04	.02	.00	-.04	.02
4.	Income (1-9)				-	.05	.04	.07	.03	-.09	-.13*	-.12	-.14*	-.02	.07	.08	.00	.05	.02
5.	Need for Cognition (1-7)					-	.39**	.03	.29**	.23**	.13*	.24**	.04	.08	.16*	.20**	.22**	-.04	-.02
6.	PANAS (Positive; 1-5)						-	.04	.33**	.21**	.27**	.38**	.02	.10	.21**	.26**	.27**	.09	.04
7.	PANAS (Negative; 1-5)							-	.04	.05	-.02	.04	-.12	-.04	-.07	.03	-.01	-.12	.03
8.	Previous Knowledge (1-5)								-	.17**	.33**	.17*	-.10	-.12	.02	.16*	.16*	.03	.02
9.	Environmental Identity (1-7)									-	.34**	.36**	.16*	.28**	.30**	.28**	.44**	-.06	-.10
10.	Involvement (1-5)										-	.47**	.14*	.29**	.19**	.20**	.36**	.03	-.04
11.	Depth of processing (1-7)											-	.42**	.37**	.37**	.33**	.60**	-.06	-.08
12.	Recall (1-13)												-	.43**	.26**	.17**	.19**	-.03	-.01
13.	Policy Support (No Cost; 1-5)													-	.46**	.13*	.33**	.05	-.05
14.	Policy Support (Minimal Cost; 1-5)														-	.65**	.31**	.01	-.06
15.	Policy Support (Maximum Cost; 1-5)															-	.32**	-.03	-.10
16.	Intentions to discuss (1-7)																-	.03	.00
17.	X_1																	-	.01
18.	X_2																		-
Mean		52.44	0.58	3.29	5.10	4.58	14.71	6.46	2.25	5.01	4.06	5.27	5.63	4.49	3.63	2.51	4.16	-0.01	.01
Standard Deviation		16.67	0.50	1.11	3.03	0.96	4.21	2.86	1.00	1.23	0.88	1.12	3.06	0.76	1.16	1.24	1.49	.47	.41

Note. * $p < .05$, ** $p < .01$

Table S7. Conditional Process Analysis for Study 1

Variables	Depth of Processing			Recall			Policy Support (No Cost)			Policy Support (Minimal Cost)			Policy Support (Maximum Cost)			Intentions to discuss		
	B	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*
X_1	-0.08	0.11	.492	0.08	0.12	.537	0.14	0.13	.272	0.01	0.13	.952	-0.06	0.13	.634	0.11	0.12	.340
X_2	-0.06	0.13	.671	0.12	0.14	.417	-0.02	0.15	.890	-0.04	0.15	.798	-0.19	0.16	.229	0.09	0.13	.495
Age	-0.12	0.06	.057	**-0.14**	**0.07**	**.036**	-0.07	0.07	.326	0.01	0.07	.895	0.07	0.07	.301	0.05	0.06	.400
Gender	0.18	0.12	.128	0.01	0.12	.935	-0.12	0.13	.361	-0.03	0.13	.794	0.01	0.13	.935	0.12	0.11	.310
Education	**0.13**	**0.06**	**.017**	0.09	0.06	.157	0.06	0.06	.331	-0.04	0.06	.505	-0.06	0.07	.401	-0.09	0.06	.135
Income	-0.08	0.06	.149	-0.07	0.06	.290	0.06	0.07	.346	**0.14**	**0.07**	**.035**	0.10	0.07	.128	0.06	0.06	.269
Previous Knowledge	-0.06	0.06	.294	**-0.15**	**0.07**	**.019**	**-0.28**	**0.07**	**.000**	-0.11	0.07	.102	0.06	0.07	.418	0.03	0.06	.608
Need for Cognition	0.11	0.06	.084	0.05	0.07	.405	0.06	0.07	.392	0.04	0.07	.574	0.05	0.07	.515	0.07	0.06	.273
PANAS (Positive)	**0.17**	**0.06**	**.007**	**-0.18**	**0.07**	**.010**	-0.04	0.07	.550	0.07	0.07	.326	0.13	0.08	.100	0.01	0.06	.864
PANAS (Negative)	0.08	0.06	.197	-0.09	0.06	.179	0.01	0.07	.897	-0.06	0.07	.412	-0.02	0.07	.782	-0.05	0.06	.363
Involvement	**0.35**	**0.06**	**.000**	-0.01	0.07	.910	**0.24**	**0.07**	**.001**	0.03	0.08	.702	0.03	0.08	.740	0.09	0.07	.169
EI	**0.14**	**0.06**	**.032**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
X_1 x EI	**0.34**	**0.12**	**.006**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
X_2 x EI	0.01	0.13	.911	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Depth of processing	-	-	-	**0.43**	**0.07**	**.000**	**0.31**	**0.08**	**0.000**	**0.38**	**0.08**	**.000**	**0.29**	**0.08**	**.000**	**0.57**	**0.07**	**.000**
Simple Slope X_1 x Low EI	**-0.36**	**0.15**	**.020**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Simple Slope X_1 x High EI	0.20	0.15	.190	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Model Summary	R^2 = 40.19, F(14,211) = 10.12, p < .001			R^2 = 26.33, F(12,213) = 6.35, p < .001			R^2 = 23.72, F(12,213) = 5.52, p < .001			R^2 = 18.42, F(12,213) = 4.01, p < .001			R^2 = 16.29, F(12,213) = 3.45, p < .001			R^2 = 39.75, F(12,213) = 11.71, p < .001		

Note. EI = Environmental Identity.

Table S8. Individual Characteristics (Standard Deviations or Percentages in brackets) for Study 2

	Control	Disgust Image	Sad Image	Total	
Number of participants	137 (35.30)	125 (32.20)	126 (32.50)	388	
Age (Years)	45.85 (17.00)	45.47 (17.34)	44.02 (16.74)	45.11 (16.74)	$F(2,384) = 0.42$, $p = .657$
Gender					
Male	54 (43.50)	69 (55.50)	59 (47.20)	189 (49.00)	χ^2 (2, N = 388) = 3.91, p = .140
Female	70 (56.50)	56 (44.50)	66 (52.80)	197 (51.00)	
Home Type					
Apartment	13 (10.40)	6 (4.40)	21 (16.70	40 (10.30)	**χ^2 (2, N = 388) = 10.72, p = .005**
House	112 (89.60)	131 (95.60)	105 (83.30)	348 (89.70)	
Education (%)					
School/Trade	74 (54.00)	74 (59.20)	79 (62.70)	227 (58.50)	χ^2 (4, N = 388) = 3.16, p = .531
Undergraduate	42 (30.70)	30 (24.00)	32 (25.40)	104 (26.80)	
Postgraduate	21 (15.30)	21 (16.80)	15 (11.90)	57 (14.70)	
Income					
< AUD$49,999	27 (26.00)	27 (24.80)	27 (24.50)	81 (25.10)	χ^2 (4, N = 323) = 0.40, p = .983
AUD$50-99,999	60 (57.70)	64 (58.70)	62 (56.40)	186 (57.60)	
> AUD$100,000	17 (16.30)	18 (16.50)	21 (19.10)	56 (17.30)	

Table S9. Inter-correlations, Means and Standard Deviations for all Measures for Study 2

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1.	Age	-	.06	.03	.18**	-.11*	-.09	-.04	.04	-.12*	-.20**	-.11*	.11*	.16**	-.06	.01	.04
2.	Male = 0, Female = 1		-	-.03	.08	.02	-.25**	.11*	.16**	.12*	.11*	.10	.01	-.08	.06	-.10	-.03
3.	Education (1-5)			-	.22**	-.08	.19**	.16**	.01	.10	.16**	.11*	.18**	.18**	.14**	.06	-.04
4.	Income (1-7)				-	.03	-.06	.10	.02	.05	.03	.11*	.15**	.12*	.00	.08	-.01
5.	Apartment = 0, House = 1					-	-.16**	-.13*	-.08	-.05	.08	.07	.01	.00	-.07	.14**	-.08
6.	Previous knowledge (1-5)						-	.34**	.21**	.30**	-.11*	.02	.09	.16**	.45**	.14**	.03
7.	Environmental Identity (1-7)							-	.36**	.54**	.02	.25**	.30**	.29**	.57**	.05	-.08
8.	Disgust sensitivity (1-7)								-	.35**	-.21**	.10*	.13*	.13*	.38**	-.04	.05
9.	Depth of processing (1-7)									-	.30**	.45**	.38**	.26**	.72**	-.01	.05
10.	Recall (0-14)										-	.31**	.20**	.07	.12*	-.04	-.08
11.	Policy Support (No Cost; 1-5)											-	.40**	.09	.27**	-.03	.01
12.	Policy Support (Minimal Cost; 1-5)												-	.66**	.36**	.03	.08
13.	Policy Support (Maximum Cost; 1-5)													-	.36**	.09	.05
14.	Intentions to discuss (1-7)														-	.00	.08
15.	X_1															-	.00
16.	X_2																-
Mean		45.11	0.51	3.27	6.70	0.90	2.36	5.30	4.30	5.39	5.32	4.42	3.61	2.62	4.63	.02	.00
Standard Deviation		16.74	0.50	1.04	3.54	0.30	1.11	1.18	1.45	1.20	3.33	0.83	1.16	1.22	1.49	.48	.40

Note. * $p < .05$, ** $p < .01$

Table S10. Conditional Process Analysis for Study 2

Variables	Depth of Processing			Recall			Policy Support (No Cost)			Policy Support (Minimal Cost)			Policy Support (Maximum Cost)			Intentions to discuss		
	B	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*
X_1	-0.10	0.09	.251	-0.06	0.09	.529	-0.06	0.10	.513	0.04	0.10	.660	0.13	0.10	.207	-0.05	0.07	.502
X_2	0.18	0.11	.081	-0.16	0.11	.156	0.01	0.11	.910	0.17	0.12	.144	0.08	0.12	.517	0.09	0.08	.252
Age	**0.09**	**0.04**	**.033**	**0.15**	**0.05**	**.001**	0.07	0.05	.156	**-0.13**	**0.05**	**.008**	**-0.17**	**0.05**	**.001**	-0.03	0.03	.369
Gender	0.16	0.09	.078	0.16	0.09	.010	0.03	0.10	.793	-0.12	0.10	.246	**-0.22**	**0.10**	**.035**	0.08	0.07	.272
Education	0.00	0.04	.922	**0.17**	**0.05**	**.000**	0.08	0.05	.074	**0.13**	**0.05**	**.006**	**0.13**	**0.05**	**.010**	0.05	0.03	.174
Income	0.03	0.04	.504	-0.02	0.05	.737	0.08	0.05	.095	0.08	0.05	.086	0.06	0.05	.207	-0.03	0.03	.400
Apartment vs House	0.12	0.14	.392	0.14	0.15	.345	0.25	0.15	.110	0.15	0.16	.351	0.14	0.16	.400	0.09	0.11	.402
Previous Knowledge	**0.13**	**0.05**	**.009**	**-0.19**	**0.05**	**.000**	**-0.12**	**0.05**	**.029**	-0.05	0.05	.345	0.04	0.06	.442	**0.25**	**0.04**	**.000**
Disgust Sensitivity	**0.14**	**0.05**	**.002**	**-0.32**	**0.05**	**.000**	-0.04	0.05	.451	0.00	0.05	.929	0.05	0.05	.386	**0.11**	**0.04**	**.002**
EI	**0.44**	**0.05**	**.000**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
X_1 x EI	**0.19**	**0.09**	**.035**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
X_2 x EI	-0.13	0.11	.220	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Depth of processing	-	-	-	**0.43**	**0.05**	**.000**	**0.48**	**0.05**	**.000**	**0.39**	**0.05**	**.000**	**0.24**	**0.05**	**.000**	**0.60**	**0.04**	**.000**
Simple Slope - $X_{1\,x}$ Low EI	**-.31**	**.13**	**.020**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Simple Slope $X_{1\,x}$ at High EI	.11	.14	.402	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Model Summary	R^2 = 35.94, F(12,372) = 17.40, p < .001			R^2 = 29.08, F(10,374) = 15.33, p < .001			R^2 = 24.28, F(10,374) = 11.99, p < .001			R^2 = 19.93, F(10,374) = 9.31, p < .001			R^2 =14.60, F(10,374) = 6.39, p < .001			R^2 = 60.11, F(10,374) = 56.36, p < .001		

Note. EI = Environmental Identity.

Table S11. Index of Moderated Mediation for X_1 (Control = -.67, Disgust = .33, Sadness = .33) and X_2 (Control = 0, Disgust = -.50, Sadness = .50) on the Dependent Variables for Study 2

	Index	*SE*	95% *CI*
X_1			
Recall	-0.00	0.04	-0.0882,0.0850
Policy support (no cost)	-0.00	0.05	-0.0927, 0.1044
Policy support (min. cost)	-0.00	0.04	-0.0794, 0.0766
Policy support (max. cost)	-0.00	0.03	-0.0540, 0.0468
Intentions to discuss	-0.00	0.06	-0.1207, 0.1207
X_2			
Recall	**-0.11**	**0.05**	**-0.2144, -0.0100**
Policy support (no cost)	**-0.12**	**0.06**	**-0.2386, -0.0112**
Policy support (min. cost)	**-0.10**	**0.05**	**-0.1948, -0.0104**
Policy support (max. cost)	**-0.06**	**0.03**	**-0.1300, -0.0068**
Intentions to discuss	**-0.15**	**0.07**	**-0.2926, -0.0138**

Note. EI = Environmental Identity.

Survey items

Involvement. Participants responded to the question "To me, the topic of stormwater management is" using a five-item semantic different scale (1 = *Unimportant/Irrelevant/Not meaningful/Unappealing/Not needed*, 5 = *Important/Relevant/Meaningful/Appealing/Needed*).

Previous Knowledge. Participants responded to the question "How much do you think you know about stormwater management?" on a 5-point Likert scale (1 = *Nothing at all*, 5 = *A great deal*).

Environmental Identity. Participants responded on a 7-point Likert scale (1 = Strongly disagree, 7 = Strongly agree) to the following statements

- "Being an environmentally friendly person is an important part of who I am"
- "I am the type of person who is environmentally friendly"
- "I see myself as an environmentally friendly person."

Need for Cognition. Participants responded on a 7-point Likert Scale (1 = *Strongly disagree*, 7 = *Strongly agree*) to the following statements

- "I really enjoy a task that involves coming up with new solutions to problems"
- "I prefer to understand why things turned out that way rather than just let things happen"
- "I don't like tasks that require no thought once I've learned them"
- "I would rather do something that is sure to challenge my thinking abilities rather than something that requires little thought"
- "I like the responsibility of handling a situation that requires a lot of thinking"
- "I prefer my life to be full of puzzles that I must solve"
- "It's not enough that something gets the job done; I care how or why it works"
- "I find great satisfaction in deliberating long and hard for hours"
- "I prefer complex to simple problems."

PANAS. Participants were asked to "Please indicate how you feel right now (i.e., at this moment of time)" on a 5-point scale (1 = *Not at all*, 5 = *A great deal*) to 10 emotions: afraid; nervous, hostile, ashamed; upset; determined; attentive; alert; inspired and active.

Depth of processing. Participants responded on a 7-point Likert scale (1 = *Strongly disagree*, 7 = *Strongly agree*) to the following 10 statements

- "My mind kept wandering as I was reading the factsheet"
- "Thoughts about other things kept popping into my mind as I read the factsheet"
- "I was easily distracted whilst reading the content of the factsheet"
- "I was able to focus on the content of the factsheet"
- "I concentrated on the content of the factsheet"

- "I paid close attention to each point that was made in the factsheet"
- "I was interested in what the factsheet had to say"
- "I found the factsheet was thought provoking"
- "I was motivated to read the factsheet"
- "The content of the factsheet made me stop and think."

Recall. Participants were asked to answer three True/False questions: "Only artificial wetlands are capable of filtering stormwater", "Soil particles are a source of stormwater pollution" and "Stormwater is treated before it enters waterways. In addition, they were asked four free-recall questions

- "The factsheet listed a number of things local authorities or water utilities can do to better manage stormwater. Please list as many as you can recall"
- "The factsheet listed a number of things community members can do to better manage stormwater. Please list as many as you can recall."
- "Thinking back to the factsheet you read earlier, which chemicals were listed as being a potential cause of toxic algae blooms?"
- "Thinking back to the factsheet you read earlier, which non-porous surfaces can contribute to stormwater run-off?".

Intentions to discuss. Participants responded on a 7-point Likert scale (1 = *Strongly disagree*, 7 = *Strongly agree*) to the following two items: "I intend to discuss the factsheet contents with others around me" and "I feel motivated to discuss the issues raised by the factsheet with others around me."

Policy support (No Cost). Participants were asked to respond on a 5-point scale (1 = *Not supportive*, 5 = *Definitely supportive*) to the question: "How supportive would you be of local authorities or water utilities implementing stormwater management strategies if these strategies had no impact on your rates or rent?".

Policy support (Minimal Cost). Participants were asked to respond on a 5-point scale (1 = *Not supportive*, 5 = *Definitely supportive*) to the question: "How supportive would you be of local authorities or water utilities implementing stormwater management strategies if these strategies had a small impact on your rates or rent (approximately $50 per year)?".

Policy support (Maximum Cost). Participants were asked to respond on a 5-point scale (1 = *Not supportive*, 5 = *Definitely supportive*) to the question: "How supportive would you be of local authorities or water utilities implementing stormwater management strategies if these strategies had a large impact on your rates or rent (approximately $250 per year)?".

Emotion (Qualitative). Participants were asked to respond to the following free-answer question: "Thinking about when you first saw the above image, how did it make you feel?".

Emotion (Quantitative). Participants were asked to respond to the question "Thinking about when you first saw the above image, please indicate the degree to which it made feel" on a 5-point scale (1 = *Not at all*, 5 = *Extremely*) to the following 10 emotions: distress, anger, fear, sadness, disgust, joy, serenity, pride, hope and inspiration.

Disgust Sensitivity. Participants responded on a 7-point Likert scale (1 = *Strongly disagree*, 7 = *Strongly agree*) to the following statements

- "I am very sensitive to feelings of disgust"
- "I am easily disgusted"
- "I react very strongly to things that disgust me."

3.7. References

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CHAPTER 4

4. Overview

In addition to disgust and sadness, the results of Study 1 (see Chapter 2) indicated that some images commonly used in communications about sustainable stormwater management, such as images of rural rivers and oceanic environments, elicit the discrete emotions of serenity or calmness (Schultz, Fielding, & Newton, 2018). Beyond happiness, there is presently little in the way of published empirical research exploring the role of different discrete positive emotions on depth of processing (whether incidental or integral), and even less on the role of calmness or serenity. Only two studies have explored the role of *incidental* serenity on depth of processing (Griskevicius, Shiota, & Neufeld, 2010; Tiedens & Linton, 2001) and both studies found that serenity led to more peripheral processing. Therefore, two experiments were conducted (Study 4, N = 384 and Study 5, N = 394) to test the effect of images that elicit *integral* serenity on depth of processing of an accompanying message about sustainable urban stormwater, as well as overall engagement with the message topic. Understanding the causal effect of images that elicit serenity is important because of the ubiquitous use of serene images in communications for sustainable urban stormwater management (Schultz et al., 2008), and also pro-environmental communication more broadly (e.g., images of pristine ocean environments or rivers and creeks in natural settings). One way to test the causal outcome of serenity on depth of processing is by using a comparison condition whereby serenity can be evaluated against another, better-understood emotion that is predicted to have the opposite effect on depth of processing (e.g., sadness). Therefore, similar to the second study described in Chapter 3, images pre-tested to elicit sadness were used as a comparison condition, in addition to a control condition that included a message with no embedded image.

4.1. Introduction

The studies presented in Chapter 3 focused on two negative-valence emotions: disgust and sadness. Indeed, much of the past research on the role of discrete emotions on message processing has focused on negative-valence emotions (Nabi, 2002; Nabi & Prestin, 2016). As such, the effects of discrete positive emotions on depth of processing have remained relatively unexplored (Cavanaugh, Bettman, Luce, & Payne, 2007; Nabi & Prestin, 2016). One potential explanation for this lack of empirical research is that much of the early appraisal literature suggests positive emotions are less differentiated than negative emotions (Ellsworth & Smith, 1988; Harmon-Jones, Bastian, & Harmon-Jones, 2016; Nabi, 1999; Smith & Ellsworth, 1985). For example, with regard to the cognitive appraisal dimension of certainty, with the exception of hope, all of the positive emotions described by Smith and Ellsworth (1985) are associated with certain-appraisals. Yet, other research suggests that different discrete positive emotions (e.g., serenity and awe) have divergent effects on depth of processing (Griskevicius et al., 2010). These mixed findings suggest that there is a need to explore the effects of positive emotions on depth of processing further, as well as overall message engagement.

The Q-sort study (Schultz et al., 2018) presented in Chapter 2 of this thesis indicated that many of the images used in communications about sustainable urban stormwater management consistently elicited the positive-valence emotion of serenity or calmness, particularly images of oceanic environments or rural creeks. Serenity, also referred to as calmness or contentment, is elicited when people feel comfortable or satisfied in response to a situation (Fredrickson, 2013). While serenity was not one of the fifteen emotions originally defined by Smith and Ellsworth's (1985) seminal work, later work by Dillard and Nabi (2006) and Tiedens and Linton (2001) established that serenity (or contentment) is associated with the cognitive appraisal of certainty. Furthermore, an experimental study assessing the effects of serenity on depth of processing (Tiedens & Linton, 2001) demonstrated effects in line with the certain-uncertain appraisal hypothesis. That is, participants induced to feel either serenity or anger (which are both associated with certain-appraisals) used more peripheral processing, as indicated by use of a source credibility heuristic than those induced to feel the discrete emotions of worry and surprise (which are both associated with uncertain-appraisals).

More recently, Griskevicius et al. (2010) also tested the assumption that all positive emotions equally motivate peripheral processing. Rather than drawing on the Appraisal-Tendency Framework, however, the authors took an evolutionary approach to make predictions regarding the effects of a range of positive emotions (e.g., awe, love, pride, and serenity) on depth of processing. Griskevicius et al. (2010, p. 3) defined serenity as "feeling relaxed, satisfied and comfortable, like all of your needs have been fulfilled, the kind of feeling that makes you want to lay around and do

nothing for a while". Drawing on this definition, they predicted that serenity would lead to more peripheral processing as the feeling is associated with turning one's attention inward rather than outward to new information (Griskevicius et al., 2010). In line with their predictions, incidental serenity was associated with shallower message processing of a persuasive message (Griskevicius et al., 2010).

To the best of my knowledge, no studies have previously tested the effect of integral serenity on depth of processing. Therefore, the aim of the two studies reported in this chapter was to assess the causal effect of images eliciting serenity empirically on depth of processing of an accompanying and related message, and in turn, on overall message engagement.

An additional aim of Study 4 was to include source credibility as an additional measure of depth of processing. Beyond self-report measures, there are a number of different ways to assess depth of processing (Petty et al., 2009; Petty & Briñol, 2015), the most common of which is to assess the influence of heuristics (sometimes called peripheral cues) on overall engagement with the message content. Heuristics have been shown to have a larger impact on message/topic engagement under shallower depths of processing (Petty & Wegener, 1998). Most heuristic manipulations involve varying the textual content of the message (e.g., varying argument quality, the number of arguments, the inclusion of stereotypes, or varying source credibility). Given that the aim was to isolate the causal role of images in influencing how people process accompanying written messages, it was important that the textual content of the message remained largely identical. Manipulating source credibility was therefore chosen for the purposes of this experiment, as it would allow the main body of text to remain identical across the experimental conditions. The only textual variation across the two studies was a brief source attribution in the introduction of the factsheet. The same source credibility manipulation (i.e., that the source of the information was attributed to either a professor or a student) was used as in the original study conducted by Tiedens and Linton (2001), which assessed the effects of incidental serenity on depth of processing.

Only participants with moderate to low environmental identities were recruited for the studies described in this chapter. The reason for this is that previous research (Chebat, Vercollier, & Gélinas-Chebat, 2003; Petty & Cacioppo, 1986; Petty & Briñol, 2015) and the findings of the studies reported in Chapter 3 indicate that emotive images do not influence depth of processing when messages are highly personally relevant (i.e., for high environmental identifiers). This is consistent with the core tenet of the ELM, that people with a strong interest in the topic are already highly motivated to engage in central message processing (Petty & Cacioppo, 1986) and will likely already be strongly supportive of pro-environmental initiatives such as sustainable urban stormwater management. Ultimately, the goal of pro-environmental communications is to provide persuasive information that will bring about a change in knowledge, attitudes, and/or behaviour

(i.e., engagement) and the likely targets of such attempts are individuals who are not already highly engaged with the target issue. Therefore, only participants with moderate to low environmental identities were recruited for Study 4 and Study 5.

A mediated model of engagement was proposed, such that the serene image condition, in comparison to the control and sad image conditions, would lead to lower engagement (i.e., poorer recall, policy support, and intentions to discuss the message content with others) via depth of processing (see Figure 1.1, Chapter 1). Support for this contention comes from Study 2 in Chapter 3, which provided weak evidence to suggest that the sad image condition increased depth of processing relative to the control condition (p = .081, see Chapter 3, Table S10). Given that past research has consistently shown that sadness motivates more central processing (Bodenhausen, Sheppard, et al., 1994; Schwarz & Bless, 1991; Tiedens & Linton, 2001), it was again predicted that the sad image condition will lead to higher levels of engagement via depth of processing in comparison to the control condition.

With regard to the source credibility manipulation, a main effect for the source credibility condition was predicted, such that people would be more engaged by the message attributed to a professor compared to information attributed to a student. However, past research indicates individuals are more susceptible to source credibility heuristics under conditions of shallower processing relative to conditions of more central processing (Petty et al., 2009; Petty et al., 1983; Petty & Wegener, 1998). As such, participants should be more susceptible to the source credibility manipulation in the serene image condition, when compared to the sad image and control (no image) conditions, and less susceptible to the source credibility condition in the sad image condition in comparison to the control (no image) condition. As with the studies described in Chapter 3, age, gender, education, income and previous knowledge were controlled for in the analyses.

4.2. Study 4

4.2.1. Image pre-test

The aim of the Study 4 pre-test was to confirm that the selected images (see Figure 4.1) elicited the target discrete emotions of serenity and sadness respectively. Image 1 was digitally altered to include a floating plastic bag, with the aim of changing the dominant elicited emotion from serenity to sadness, while keeping the images as similar as possible to control for potential confounding variables.

Figure 4.1. Image 1 (left, pristine ocean; target emotion serenity) and Image 2 (right, non-pristine ocean; target emotion sadness)

Note. To avoid confusion, in the text each image will be labelled by its target emotion, such that the pristine ocean image is denoted 'serene image' and the non-pristine ocean as 'sad image'.

The image pre-test was conducted in June and July 2017 using a mixed Australian and American community sample (N = 114, 52.6% Male, M_{age} = 37.96 years, SD_{age} = 19.59 years) recruited from an online platform (www.microworkers.com.au). Participants were paid US$1.00 for their time. The survey was hosted on the Qualtrics platform. A 2-level between-subjects design was used, whereby each participant was asked to rate either Image 1 (Serene) or Image 2 (Sad). The dominant emotion elicited by each image was assessed using the same two measures used in the previous chapter (see Chapter 3). That is, participants were first asked to indicate "How did the image make you feel?" The open-ended responses was coded one (1) for participants who mentioned feeling a discrete emotion or a related synonym or zero (0) for those who did not mention any of the target words. Participants were also asked to record their emotional reaction on a 5-point Likert scale (1 = *Not at all*, 5 = *A great deal*) in terms of 10 discrete emotions.

As can be seen in Table 4.1, the median score for serenity for Image 1 (Serene) was above the mid-point, and the median score for sadness with respect to Image 2 (Sad) was below the mid-point. To test for differences between the conditions, a series of Mann-Whitney U tests were performed, with emotion as a dependent variable and the image condition as the between-subjects variable. As can be seen in Table 4.1, the tests revealed that Image 1 (Serene) scored higher than Image 2 (Sad) with respect to all positive-valence discrete emotions. Conversely, Image 2 (Sad) scored higher for all negative-valence emotions.

With regard to the dominant positive emotion elicited by Image 1 (Serene), a series of Wilcoxon Signed-Rank tests (with a Bonferroni corrected α = .013) revealed that the score for serenity was higher than all four other positive emotions, ps < .010. With regard to the dominant emotion elicited by Image 2 (Sad), the paired tests indicated no significant differences between any of the emotions, ps > .096.

Table 4.1. Median Scores for the Quantitative Emotion Scales for Image Pretest for Study 4

	Image 1 (Serene condition) (n = 59)	Image 2 (Sad condition) (n = 54)	p value
Joy	4.00	2.00	< .001
Serenity	4.00	2.00	< .001
Hope	3.00	1.00	< .001
Pride	3.00	1.00	.002
Inspiration	3.00	2.00	.001
Disgust	1.00	2.00	< .001
Distress	1.00	2.00	< .001
Anger	1.00	2.00	< .001
Fear	1.00	2.00	< .001
Sadness	1.00	2.00	< .001

Whilst it was clear from the quantitative data that serenity was the dominant emotion elicited by Image 1 (Serene) , it was not clear whether the target emotion of sadness was the dominant negative emotion elicited by Image 2 (Sad, i.e., non-pristine ocean image). However, as with the pre-test for Study 3, clear differences were evident when analysing the qualitative data (see Table 4.2).

Table 4.2. Qualitative Coding from Emotion Question for Image Pre-test for Study 4

	Image 1 (Serene condition) (n = 59)	Image 2 (Sad condition) (n = 54)	p value
Certain-Appraisals			
Serenity/Calm	34	16	χ^2 (1, 113) = 8.96, p = .003
Disgust	0	1	
Angry	0	2	
Positive Adjectives (e.g., good)	19	4	
Total	50	24	χ^2 (1, 113) = 20.61, p < .001
Uncertain-Appraisals			
Sad	0	22	χ^2 (1, 113) = 29.85, p < .001
Negative Adjectives (e.g., bad)	0	8	
Worry	1	1	
Total	1	26	χ^2 (1, 113) = 33.46, p < .001
Descriptive response	7	5	χ^2 (1, 113) = 0.20, p = .653

As expected, the above table clearly shows that sadness was nominated more often in relation to the Image 2 (Sad) condition in comparison to the Image 1 (Serene) condition. Also in line with what was expected, serenity was nominated more frequently than any other discrete emotion in relation to the Image 1 (Serene) condition. While a notable number of participants also nominated serenity as the dominant emotion for Image 2 (Sad condition; n = 16), this was

approximately half the number of participants that nominated either sadness or negative affect (*n* = 34) and it was significantly less than the proportion in the Image 1 (Serene) condition. Further, other emotions related to uncertain-appraisals were mentioned more frequently in the Image 2 (Sad) condition compared to the Image 1 (Serene) condition and the reverse was true for emotions associated with certain-appraisals. The pattern of findings suggests that the images were suitable for use in Study 4, as the dominant discrete emotion elicited by Image 1 (Serene) was indeed the target emotion of serenity, followed by other emotions associated with certain-appraisals. Conversely, the dominant emotion elicited by Image 2 (Sad) condition was sadness, followed by other emotions associated with uncertain-appraisals, which are predicted to have a positive effect on depth of processing.

4.2.2. Method

The study was conducted in July 2017 and used a 2 (source credibility: low, high) x 3 (image: no image, serene image, sad image) between-subjects design. The experimental stimulus, a factsheet about stormwater pollution was constructed specifically for the study and varied only in terms of the image used and the source attribution. The factsheet and survey were hosted on the online Qualtrics platform.

4.2.2.1.Participants

The data was collected using a paid on-line research panel with quotas used to ensure a relatively even balance of age and gender. A total of 989 Australian participants were screened out and unable to complete the survey: 796 scored higher than 5.00 on the initial environmental identity scale and 193 failed an attention check item. A further 33 participants indicated that their primary language was not English and were not included in the final sample. The final sample size was 384 participants. Participant ages ranged from 19 years to 84 years (M = 47.24, SD = 17.12). The sample consisted of a balanced gender split (51% female) plus one gender-neutral participant. The socio-demographics of the sample, including gender, age, education, income, and home ownership, are presented in Table 4.3. Analyses indicated no significant differences for any sociodemographic variables across conditions, as would be expected with experimental randomisation, ps > .060.

Table 4.3. Individual Characteristics for Study 4 (Standard Deviations or Percentages in brackets)

	Control	Serene Image	Sad Image	Total	
Number of participants	132 (34.40)	124 (32.30)	128 (33.30)	384	
Age (Years)	47.39 (17.76)	49.29 (16.79)	46.96 (16.69)	47.24 (17.12)	$F(2, 381) = 1.48$, $p = .229$
Gender					
Male	70 (53.40)	62 (50.00)	66 (51.60)	198 (51.70)	χ^2 (2, N = 383) = 0.30, p = .860
Female	61 (46.60)	62 (50.00)	62 (48.20)	185 (48.30)	
Home ownership					
Rented	38 (29.70)	54 (43.90)	49 (39.20)	141 (37.50)	χ^2 (2, N = 376) = 5.64, p = .060
Owned	90 (70.30)	69 (56.10)	76 (60.80)	235 (62.50)	
Home type (%)					
Apartment	33.00 (25.00)	31 (25.00)	30 (23.40)	94 (24.50)	χ^2 (2, N = 384) = 0.11, p = .945
House	99 (75.00)	93 (75.00)	98 (76.60)	290 (75.50)	
Education (%)					
School	50 (37.80)	56 (45.20)	38 (29.70)	144 (37.50)	χ^2 (4, N = 384) = 8.30, p = .081
Trade/TAFE	41 (31.10)	37 (29.80)	54 (42.20)	132 (34.40)	
University	41 (31.10)	31 (25.00)	36 (28.10)	108 (28.10)	
Income					
< AUD$49,999	48 (36.40)	59 (47.60)	43 (33.90)	150 (39.20)	χ^2 (4, N = 383) =6.21, p = .184
AUD$50-99,999	50 (37.90)	37 (29.80)	53 (41.70)	140 (36.60)	
> AUD$100,000	34 (25.80)	28 (22.60)	31 (24.40)	93 (24.40)	

4.2.2.2. Procedure and Measures

After providing consent, participants were asked a question assessing the strength of their environmental identity. Using a scale developed by Fielding, McDonald, and Louis (2008), participants were asked to indicate their agreement or disagreement with three items (e.g., "I am the type of person who is environmentally friendly") on a scale from 1 = *Strongly disagree* to 7 = *Strongly agree*. Participants that answered 'strongly agree' or 'agree' to two or more of the items were excluded from the study. For the remaining participants, responses to the three items were averaged to create an *environmental identity* scale. Means, standard deviations, and reliability coefficients of this scale and others are described in Table 4.6.

The participants were then asked, "How much do you think you know about stormwater management?" on a scale from 1 = *Nothing at all* to 5 = *A great deal*. This single-item measure of perceived *previous knowledge* was a control variable and was included as past research has established that previous knowledge is significantly correlated with both depth of processing and overall engagement (Dillard & Nabi, 2006; Nabi & Prestin, 2016; Schultz & Fielding, 2014; Wood, Kallgren, & Preisler, 1985). To reduce the transparency of the study, participants were also asked to indicate their prior knowledge in relation to both solar power and genetically modified food.

Participants were then randomly assigned to read a brief introductory paragraph that included the source manipulation. Half of the participants were told: "This information is based on a report prepared under the supervision of Water and Engineering Professors". The remaining participants read "This information is based on a report prepared as part of a student project". All participants where then shown a factsheet, which included identical information about the types, causes, and effects of stormwater pollution but which was also randomly allocated to include one of three image conditions.

For participants assigned to the *serene image* condition, the factsheet was embedded with an image of a pristine underwater ocean scene (see Figure 4.1, Image 1). In the *sad image* condition, the image was digitally manipulated to include a plastic bag floating in the ocean (see Figure 4.1, Image 2). In the *control* condition, no image was included in the factsheet. After reading the factsheet, participants answered a series of questions assessing depth of processing, message recall, policy support, and intentions to discuss the message content with others. Excluding message recall, the items were identical to the measures used in Study 2 and 3 (See Chapter 3).

The message recall questions were specific to the content of the factsheet. Participants responded to three free-response questions (e.g., "The factsheet listed a number of types of stormwater pollution. Please list as many as you can recall" and "The factsheet listed a number of causes of stormwater pollution. Please list as many as you can recall"). Responses were independently scored by two coders: incorrect answers (0), partially correct answers (0.5) and

correct answers (1). Total scores could range from 0 – 13. The average measure for the Intraclass Correlation Coefficient was .998, $F(383,383) = 440.80$, $p < .001$, confirming high inter-coder reliability. A total message recall score was generated by averaging the sum of the two coder's scores, with higher scores indicating higher levels of message recall.

To assess whether the experimental manipulation of source credibility was successful participants responded to two questions. Participants were first asked to indicate, "Who or what was the source of the information contained in the factsheet?" The response options were: "a student report"; "a report prepared under the supervision of Water and Engineering Professors"; or, "*I don't recall."* Participants were also asked to indicate the extent to which the source was credible, qualified, trustworthy, reliable, and an expert on a 5-point semantic differential scale. The five items were averaged to create a *source credibility* scale, whereby high scores indicated that the source was highly credible.

To confirm the dominant emotion elicited by each of the three image conditions (i.e., serene image, sad image, and no image) participants responded to a free-response question: "Thinking back to when you first saw the above factsheet, please indicate how it made you feel?" Again, participants were scored one (1) if they mentioned feeling a specific discrete emotion or a related synonym and zero (0) if they did not mention any of the target emotion words.

4.2.3. Results

4.2.3.1. Manipulation Check

With regard to the source credibility manipulation, a 2 (source credibility: low, high) x 3 (image: serene, sad, control-no image) ANOVA, with source credibility as the dependent variable, confirmed the predicted main effect for source, $F(1, 378) = 13.05$, $p < .001$, $\eta^2 = .03$. Participants in the Professor condition indicated that the source of their information was more credible when compared to participants in the student condition. No main effect was present for the type of image, $F(2, 378) = 1.10$, $p = .335$, $\eta^2 = .01$, nor was the interaction significant, $F(2, 378) = 0.48$, $p = .619$, $\eta^2 < .01$. Means and standard deviations are in Table 4.4.

Table 4.4. Means and Standard Deviations for Study 4 on Source Credibility

	Source		
	Student	Professor	Total
Condition			
Control	3.62 (0.81)	3.96 (0.81)	3.80 (0.82)
Sad Image	3.56 (0.84)	3.74 (0.78)	3.65 (0.81)
Serene Image	3.55 (0.79)	3.92 (0.70)	3.72 (0.77)
Total	3.58 (0.81)	3.87 (0.77)	3.73 (0.80)

While evidence for the predicted main effect of source credibility was found, the mean difference between the two conditions was small: representing less than a 0.30 shift on a 5-point scale. This small effect is likely explained by the fact that only half of the participants could correctly identify the source of the information (51.2% of participants in the high credibility condition and 48.8% in the low source credibility condition). The small effect size and the inability of the participants to confirm the source of the information suggests that the manipulation was not very strong. Therefore, the analyses below are reported with the two conditions collapsed, and measured source credibility was included as a covariate.[14]

The emotion manipulation check results can be seen in Table 4.5. Chi-square analyses confirmed significant differences between the Serene and Sad image conditions. A visual inspection of the responses shows that serenity was clearly mentioned more frequently in the serene image condition (n = 17) compared to both the sad image (n = 0) and control conditions (n = 6). Importantly for the hypothesised direction of effects, emotions associated with certain cognitive appraisals were mentioned more frequently in the serene image condition compared to the other two conditions. Follow-up tests (with a Bonferroni adjusted $\alpha = .017$) found that, with regard to certain-valence emotions, the control and sad image conditions were not different from each other, p = .186. However, emotions associated with certain cognitive appraisals were mentioned more frequently in the serene image condition, compared to both the control condition ($p < .001$) and the sad image condition ($p = .001$).

[14] All planned analyses were also conducted with the manipulation, however, no significant effects were found for this variable.

Table 4.5. Qualitative coding for the Manipulation Check for Study 4

	Serene Image (*n* = 123)	Sad Image (*n* = 126)	Control (*n* = 130)	*p* value
Certain-Appraisal				
Serenity/Calm	**17**	**0**	**6**	χ^2 (2, 379) = 21.75, $p < .001$
Positive Affect	22	2	2	
Bored	2	6	3	
Anger	0	5	4	
Disgust	2	3	4	
Guilt	2	2	2	
Total	**45**	**23**	**16**	χ^2 (2, 379) = 23.66, $p < .001$
Uncertain-Appraisal				
Sad	**10**	**26**	**12**	χ^2 (2, 379) = 10.91, $p = .004$
Negative Affect	5	6	2	
Surprise	0	3	2	
Worry	6	7	12	
Total	**21**	**42**	**28**	χ^2 (2, 379) = 9.68, $p = .008$
Interest	**11**	**9**	**22**	χ^2 (2, 379) = 7.18, $p = .028$
No emotion	17	22	20	χ^2 (2, 379) = 0.48, $p = .788$
Descriptive response	28	32	44	χ^2 (2, 379) = 4.43, $p = .109$

Visual inspection of Table 4.5 also showed that sadness was mentioned more frequently in the sad image condition (n = 26) compared to the serene image (n = 10) and control (n = 12) conditions. Similarly, there was a difference between the conditions with regard to the total mentions of emotions that are associated with uncertain-appraisals, whereby such emotions were mentioned more frequently in the sad image condition compared to the serene image condition (p = .003). As predicted, there was no difference between the serene image and control image (p = .369) conditions with regard to emotions associated with uncertain appraisals. However, contrary to what was predicted, there was no significant difference, using the Bonferroni adjustment, between the sad image and the control condition (p = .034) on the uncertain appraisal emotions overall. There was a significant difference between the conditions with regard to participants reporting that they felt ‘interested’ or ‘curious’ in response to the factsheet. Follow-up tests showed that interest was nominated frequently in the control condition when compared to the sad image condition (p = .016) but not (using a Bonferroni adjustment) more than the serene image condition (p = .040), and there was no difference between the sad and serene image conditions (p = .601).

Finally, whilst a large number of participants gave either descriptive (e.g., “like we should do something about it” or “fairly formal and well laid out”) or no emotion (e.g., “nothing” or “neutral”) responses, there were no significant differences across the conditions for these two types of more neutral responses.

4.2.3.2.Focal Analyses

The frequency of missing data was less than 5% for all variables (Tabachnick & Fidell, 2007). Ten univariate outliers (> 3 *SD*s) on the environmental identity scale were identified and winsorised (Field, 2013; Tabachnick & Fidell, 2007). Five multivariate outliers were removed using the Mahalanobis' distance criterion ($\alpha = .001$; Tabachnick & Fidell, 2007), leaving 379 participants for the mediation model.

To test the proposed mediation model, two orthogonal contrast/effect codes were created: the first compared the serene condition to the combined control and sad image conditions (X_1: Control = -.33, Sad Image = -.33, Serene = .67) and the second compared the sad condition to the control condition (X_2: Serene Image = 0, Control = -.50, Sad Image = .50). Table 4.6, presents the correlations, means, and standard deviations. At the zero-order level, the independent variables (X_1 and X_2) were not correlated with any variables, excluding a negative association between X_2 (i.e., comparing the sad image condition to the control condition) and depth of processing and recall. Depth of processing was positively correlated with all dependent variables, excluding policy support (maximum cost). All dependent variables were positively associated with each other, excluding policy support (maximum cost), which was positively associated with policy support (minimal cost) and willingness to discuss only.

Table 4.6. Means, Standard Deviations, Bi-variate Correlations and Reliability Coefficients for Study 4

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Age	-														
2. Gender (0 = Male; 1 = Female)	.11*	-													
3. Education (1-5)	.10*	-.04	-												
4. Income (1-12)	.26**	.02	.20**	-											
5. Previous knowledge (1-5)	-.03	-.22**	.13*	.02	-										
6. Source credibility (1-5)	-.18**	.07	-.13*	-.07	-.05	-									
7. Environmental identity (1-7)	-.01	.06	-.11*	-.02	.11*	.17**	-								
8. Depth of processing (1-7)	-.23**	.10*	-.06	.03	.10	.46**	.28**	-							
9. Recall (0-13)	-.13*	.09	-.01	-.04	.01	.20**	.13*	.47**	-						
10. Policy support (Nil cost; 1-5)	-.01	.07	-.05	.10*	.04	.30**	.20**	.46**	.40**	-					
11. Policy support (Min cost; 1-5)	.09	.07	.06	.13*	-.01	.27**	.17**	.20**	.25**	.32**	-				
12. Policy support (Max cost; 1-5)	.20**	.03	.11*	.07	.04	.12*	.11*	.01	.06	-.01	.64**	-			
13. Intentions to discuss (1-7)	-.08	.05	-.03	.02	.18**	.37**	.31**	.56**	.27**	.34**	.26**	.19**	-		
14. X_1	-.08	.02	-.08	-.07	-.03	-.00	-.01	-.03	-.03	.03	.03	-.02	-.04	-	
15. X_2	.04	.01	.01	-.01	.01	-.08	-.02	-.10*	-.16**	-.05	-.05	.00	-.06	.00	-
Mean	47.24	0.49	2.98	5.45	1.99	3.73	4.22	4.93	3.88	4.18	3.08	2.15	3.97	0.01	-0.01
Standard Deviation	17.12	0.51	0.99	3.79	0.94	0.80	0.91	1.09	3.28	0.90	1.22	1.14	1.29	0.47	0.41
Reliability (α)	-	-	-	-	-	.94	.91	.94	-	-	-	-	.94	-	-

Note. * $p < .05$, ** $p < .01$

To test whether the hypothesised effect of the experimental conditions on each of the five dependent variables (i.e., recall of factsheet content, three measures of policy support, and intentions to discuss the message content with others) was mediated by depth of processing, conditional process analyses (Model 4 PROCESS Macro Version 3.00 for SPSS) were used. Bootstrapping of 5000 samples was used, with 95% confidence intervals (Hayes, 2013). All continuous variables were standardised prior to analysis. The following variables were controlled for: age, gender, education, income, previous knowledge, and perceptions of source credibility. The impact of each experimental contrast was considered controlling for the other contrast. The coefficients for all five models are presented in Table 4.7.

The direct effects of the image experimental manipulations on each of the dependent variables were not significant save for a negative direct effect of X_2 (i.e., comparing the sad image to the control condition) on recall. That is, for participants that viewed the sad image, their ability to recall the message content was significantly poorer when compared to the control condition (*DE* = -0.26, *SE* = 0.11, 95% *CI* = -0.40732, -0.00374). An initial test of whether the negative direct effect of the sad image condition on recall was mediated by depth of processing, was not reliable (see Table 4.7; *IE* = -0.09, *SE* = 0.05, 95% *CI* = -0.1956, 0.0026).

4.2.3.3.Post-hoc Analyses

Although high environmental identifiers were screened from participating in this study, the consistent moderating effect of environmental identity in Studies 2 and 3 suggested the need to re-run each model to test strength of environmental identity as a moderator for all five dependent variables (Model 7 PROCESS Macro Version 3.00 for SPSS; Hayes, 2013). It is feasible that the differences in low and moderate levels of environmental identity may still act as a boundary condition such that the effects are attenuated for moderate environmental identifiers. Therefore, the impact of each experimental contrast was re-examined, while controlling for the other contrast, uniquely and in interaction with environmental identity. The coefficients for these analyses are presented in Table 4.8.

The overall index of moderated mediation confirmed that environmental identity was moderating the indirect pathway between the serene image condition (i.e., X_1) and four of the dependent variables via depth of processing: recall (*Index* = 0.14, *SE* = 0.06, 95% *CI* = 0.0232, 0.2605); policy support with no cost implications (*Index* = 0.12, *SE* = 0.05, 95% *CI* = 0.0167, 0.2298); policy support with minimal cost implications (*Index* = .04, *SE* = .03, 95% *CI* = 0.0017, 0.1031); and intentions to discuss (*Index* = .14, *SE* = .06, 95% *CI* = 0.0244, 0.2676). The regression coefficients for the conditional path analysis for the dependent variable of recall are displayed in Figure 4.3. For the fifth outcome variable, policy support when it had large cost implications, the

overall index of moderated mediation for X_1 was not significant (*Index* = -.00, *SE* = .02, 95% *CI* = -.0363, .0341).

Simple slopes analysis of the interaction of image and environmental identity on depth of processing indicated that at lower levels of environmental identity, the effect of the serene image on depth of processing was significant and negative, *b* = -.31, *p* = .014, but the association was not significant at higher, moderate levels of environmental identity, *b* = .17, p = .134. Table 4.8 describes the overall indirect effects for the outcome measures at low and moderate levels of environmental identity.

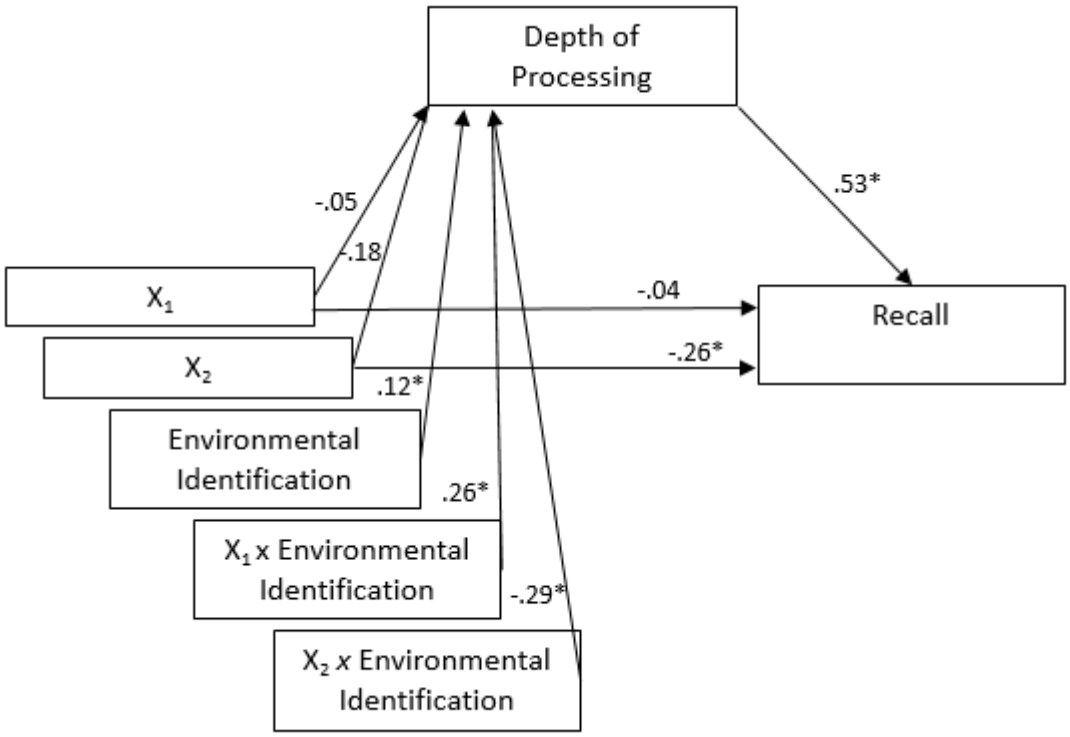

Figure 4.2. Conditional effect of X_1 (serene image versus sad and control conditions), X_2 (sad image versus control condition) and Environmental Identity on Recall through Depth of Processing for Study 4

Note. The regression coefficients for the 6 included covariates (see Table 4.7) were not included to reduce visual clutter. *$p < .05$

In addition, the overall index of moderated mediation confirmed that environmental identity was moderating the indirect pathway between the sad image condition (i.e., X_2) and four of the dependent variables: recall (*Index* = -0.15, *SE* = 0.06, 95% *CI* = -0.2194, -0.0354); policy support with no cost implications (*Index* = -0.14, *SE* = 0.06, 95% *CI* = -0.2507, -0.0277); policy support with minimal cost implications (*Index* = , *SE* = .03, 95% *CI* = -.1127, -.0025); and, intentions to discuss (*Index* = -.16, *SE* = .07, 95% *CI* = -.2873, -.0287). The regression coefficients for the conditional path analysis for the dependent variable of recall are displayed in Figure 4.2. As with

the indirect effect of X_1, the overall index of moderated mediation for X_2 was not significant for policy support when it had a large cost implication (*Index* = -.00, *SE* = .02, 95% *CI* = -.0394, .0402). At lower levels of environmental identity, the effect of the sad images on depth of processing was not significantly different from the control condition, $b = .11$, $p = .449$. The effect of the sad image condition on depth of processing was negative at moderate levels of environmental identity, $b = -.43$, $p < .001$. That is, when participants with higher environmental identities were presented with the sad image, they reported lower levels of depth of processing. Table 4.9 describes the indirect effects on the outcome variables at low and moderate levels of environmental identity.

Table 4.7. Conditional Process Analysis for Study 4 (Model 1)

Variables	Depth of Processing			Recall			Policy support (No cost)			Policy support (Minimal cost)			Policy support (Maximum cost)			Willingness to discuss		
	B	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*
X_1	-.06	.09	.528	-.04	.10	.664	.08	.09	.416	.11	.10	.290	.01	.10	.910	-.07	.09	.423
X_2	-.17	.10	.075	**-.26**	**.11**	**.022**	-.00	.11	.996	-.04	.12	.730	-.03	.12	.777	.01	.10	.883
Age	**-.17**	**.05**	**.000**	-.01	.05	.932	.00	.05	.977	**.15**	**.05**	**.005**	**.22**	**.05**	**.000**	.06	.04	.156
Gender	**.23**	**.08**	**.006**	.06	.09	.553	.01	.09	.907	.01	.10	.889	.01	.10	.885	-.01	.08	.860
Education	-.01	.04	.800	.04	.05	.397	-.01	.05	.775	.09	.05	.088	**.12**	**.05**	**.020**	.02	.04	.647
Income	**.10**	**.04**	**.015**	-.07	.05	.168	**.09**	**.05**	**.064**	.08	.05	.111	-.00	.05	.939	-.02	.04	.636
Previous knowledge	**.11**	**.04**	**.009**	-.04	.05	.461	-.01	.05	.750	-.04	.05	.408	.04	.05	.420	**.13**	**.04**	**.002**
Source credibility	**.43**	**.04**	**.000**	-.07	.05	.171	.05	.05	.359	**.20**	**.06**	**.000**	**.15**	**.06**	**.009**	**.11**	**.05**	**.027**
EI	**.12**	**.04**	**.007**	.02	.05	.732	.09	.05	.062	**.16**	**.05**	**.002**	**.12**	**.05**	**.028**	**.15**	**.04**	**.001**
Depth of processing	-	-	-	**.53**	**.06**	**.000**	**.45**	**.06**	**.000**	.14	.06	.002	-.02	.06	.772	**.51**	**.05**	**.000**
Model Summary	R^2 = .33, F(9,369) = 20.33, p < .001			R^2 = .25, F(10, 369) = 12.34, p < .001			R^2 = .25, F(10, 369) = 12.67, p < .001			R^2 = .15, F(10, 369) = 6.06, p < .001			R^2 = .88, F(10, 369) = 3.57, p < .001			R^2 = .39, F(10, 369) = 23.90, p < .001		
Indirect Effect (X_1)				*IE* = -.03, *SE* = .05, 95% CI = -.12, .07			*IE* = -.03, *SE* = .04, 95% CI = -.11, .06			*IE* = -.01, *SE* = .01, 95% CI = -.04, .02			*IE* = .00, *SE* = .01, 95% CI = -.01, .01			*IE* = -.03, *SE* = .05, 95% CI = -.15, .06		
Indirect Effect (X_2)				*IE* = -.09, *SE* = .05, 95% CI = -.20, .03			*IE* = -.08, *SE* = .04, 95% CI = -.16, -.01			*IE* = -.02, *SE* = .02, 95% CI = -.06, .00			*IE* = .01, *SE* = .01, 95% CI = -.02, .03			*IE* = -.09, *SE* = .05, 95% CI = -.18, .00		

Note. EI = Environmental Identity

Table 4.8. Conditional Process Analysis for Study 4 (Model 2)

Variables	Depth of Processing			Recall			Policy support (No cost)			Policy support (Minimal cost)			Policy support (Maximum cost)			Intentions to discuss		
	B	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*
X_1	-.05	.13	.539	-.04	.10	.663	.08	.10	.727	.11	.10	.301	.01	.11	.917	-.07	.09	.423
X_2	-.18	.10	.066	**-.26**	**.11**	**.021**	-.00	.11	.967	-.05	.12	.688	.03	.12	.811	.01	.10	.938
Age	**-.17**	**.04**	**.000**	-.01	.05	.913	-.00	.05	.921	**.13**	**.05**	**.010**	**.21**	**.05**	**.000**	.05	.05	.244
Gender	**.23**	**.08**	**.005**	.06	.09	.532	.02	.09	.788	.04	.10	.698	.03	.10	.746	.01	.08	.916
Education	-.01	.04	.717	.04	.05	.410	-.02	.05	.663	.08	.05	.148	.11	.05	.03	.01	.04	.859
Income	**.10**	**.04**	**.018**	-.07	.05	.169	.09	.05	.060	.08	.05	.103	-.00	.05	.971	-.02	.04	.686
Previous knowledge	**.11**	**.04**	**.009**	-.03	.05	.487	-.00	.05	.960	-.02	.05	.703	.06	.05	.259	**.15**	**.04**	**.000**
Source credibility	**.43**	**.04**	**.000**	-.07	.05	.175	.05	.05	.309	**.21**	**.06**	**.000**	**.158**	**.06**	**.007**	**.11**	**.05**	**.017**
EI	**.12**	**.04**	**.005**	-	-		-	-	-	-	-	-	-	-	-	-	-	-
X_1 x EI	**.26**	**.09**	**.004**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
X_2 x EI	**-.29**	**.10**	**.004**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Depth of processing	-	-	-	**.53**	**.06**	**.000**	**.47**	**.06**	**.000**	**.16**	**.06**	**.008**	.00	.06	.986	**.54**	**.05**	**.000**
Model Summary	R^2 = .36, F(11,367) = 18.87, p < .001			R^2 = .25, F(9,369) = 13.73, p < .001			R^2 = .25, F(9,369) = 13.59, p < .001			R^2 = .12, F(9,369) = 5.54, p < .001			R^2 = .76, F (9,369) = 3.38, p < .001			R^2 = .35, F(9,373) = 22.73, p < .001		

Note. EI = Environmental Identity

Table 4.9. Indirect Effect of X_1 and X_2 on the Dependent Variables at Low and Moderate Levels of Environmental Identity.

	X_1						X_2					
	Low EI			Moderate EI			Low EI			Moderate EI		
	IE	*SE*	*CI*	*IE*	*SE*	*CI*	*IE*	*SE*	*CI*	*IE*	*SE*	*CI*
Recall	**-.16**	**.08**	**-.3355, -.0012**	.09	.06	-.0250, .2093	.06	.08	-.1085, .2181	**-.23,**	**.07**	**-.3644, -.0961**
Policy support (no cost)	**-.14**	**.07**	**-.2967, -.0027**	.07	.06	-.0238, .1922	.05	.07	-.1000, .1945	**-.20**	**.06**	**-.3299, -.0829**
Policy support (min. cost)	**-.05**	**.04**	**-.1309, -.0018**	.03	.02	-.0073, .0786	.02	.03	-.0351, .0858	**-.07**	**.03**	**-.1451, -.0115**
Policy support (max. cost)	-.00	.02	-.0459, .0424	.00	.01	-.0275, .0258	.00	.01	-.0243, .0260	-.00	.03	-.0536, .0577
Intentions to discuss	**-.16**	**.09**	**-.3430. -.0039**	.09	.06	-.0238, .2186	.05	.09	-.1146, .2303	**-.23**	**.07**	**-.3740, -.0963**

Note. EI = Environmental identity.

4.2.4. Discussion

Study 4 assessed the causal effect of images that elicit the integral emotion of serenity on depth of processing, as well as overall message engagement, in comparison to an image that elicited the integral emotion of sadness and to a control condition that included no image. Both studies described in Chapter 3 indicated that environmental identity was moderating the effect of the images on engagement via depth of processing such that the images did not influence depth of processing for participants with strong environmental identities. Therefore, only participants with low to moderate environmental identities were recruited for this study.

Despite limiting the sample to only low and moderate environmental identities, the results from Study 4 indicated that environmental identity was still moderating the effects, providing further evidence to suggest that the identified effects for integral emotions associated with certain cognitive appraisals exist only for participants with *low* environmental identities. Specifically, the results indicate that images that elicit disgust (as in Study 1) and now serenity (in Study 4) lead people with low environmental identities to lower their depth of processing compared to the image eliciting emotions that are associated with an uncertain cognitive appraisal (i.e., sadness) and compared to a control condition that includes no image. The finding is consistent with past research demonstrating that the cognitive appraisal dimension of certainty can play an important role in terms of motivating or demotivating depth of message processing (Tiedens & Linton, 2001), as well as past research that shows that serenity leads to lower depth of processing (Dillard & Peck, 2000; Griskevicius et al., 2010).

The results for the sadness condition are more difficult to interpret. The sad image condition did not increase depth of processing relative to the control group as predicted. Specifically, no significant difference was found between the sad image and control condition for low environmental identifiers and, even more unexpectedly, for moderate environmental identifiers in Study 4 it was found that the sad image led to lower depth of processing. These unexpected results for low and moderate identifiers are discussed in turn.

With regard to low environmental identifiers, it is important to recall that, rather than being a neutral baseline condition, the control condition involved reading a list of facts about stormwater that participants did not know, and the dominant emotion elicited by the control condition tended to be interest. What the findings suggest is that emotions associated with certain-appraisals (i.e., serenity) decreases depth of processing relative to emotions associated with uncertain-appraisals (i.e., sadness) for people with low environmental identities, however, the sadness elicited by the image does not increase depth of processing *over and above* the motivational-goals of interest.

Furthermore, the absence of significant differences for low environmental identifiers between the sad image and control conditions is consistent with the results of the manipulation

check, which identified no significant differences in uncertain cognitive appraisals between these conditions. Given that it is the cognitive appraisal of feeling uncertain that motivates depth of processing rather than something inherent to each specific discrete emotion (Tiedens & Linton, 2001), the fact that depth of processing did not differ between the sad and control conditions may have been because there were no differences in uncertain appraisal between the two conditions.

Among moderate environmental identities (remembering very high environmental identities were excluded from the study), the serene image did not decrease depth of processing. However, contrary to what was expected, the sad image led, via depth of processing, to lower overall engagement with the message topic (i.e., lower recall of factsheet content, lower levels of support for policies with no or minimal cost implications, as well as lower intentions to discuss the message content with others). One explanation of these findings is provided by Nabi (1999) who argues that three factors are central to the study of the persuasive effects of message relevant emotions: the type of emotion elicited, the motivation or goal associated with the emotion experienced, and the receivers' expectation that the message will provide goal-relevant (i.e., reassuring) information. Drawing on this reasoning, when the message is more personally relevant (as would be the case for people with moderate environmental identities versus people with low environmental identities), the recipient of the message moves away from using emotion as a simple peripheral cue and instead engages in what Nabi refers to as "motivated processing" (Dillard & Nabi, 2006; Nabi, 1999). That is, the emotion's impact will be dependent on whether the recipient believes that there is a way to effectively address the motivational goal associated with the emotion experienced (Dillard & Nabi, 2006; Nabi, 1999). Dillard and Nabi (2006) suggest that the motivational goal associated with sadness is coping with loss. Put another way, rather than the cognitive appraisal of certainty (elicited by the image) acting as a simple heuristic, the feeling of sadness may have motivated participants with moderate environmental identities to engage in a motivated search to achieve the goal of coping with the feeling of sadness. Nabi (1999) argues that if reassurance cues are present (i.e., recipients feel assured that the information content will help achieve the goal), the receiver should accept the message's recommendations, whereas, if the message does not contain such reassurance cues, message disengagement is likely.

A review of the factsheet used in Study 4 (see Appendix F) revealed an absence of reassurance cues that could inform message recipients of the actions they could take to reduce or manage the impact of stormwater on catchment health. Indeed, one participant noted: "I am disappointed with this survey. The causes were well outlined but there were no solutions offered. Storm water must be captured, treated and reused". Because participants with moderate environmental identities did not have a way to cope with the loss associated with the sadness elicited by an image of a non-pristine ocean, they may have reduced the depth to which they

processed the factsheet in line with an emotional goal-attainment hypothesis. Although this contention is speculative and the role of providing efficacy information when eliciting integral sadness has not been established empirically, it is an avenue worthy of further exploration. Therefore, a second study was undertaken.

4.3. Study 5

Study 5 aimed to build on the results of Study 4 in four ways. The first was to re-examine the results of Study 4, which found that the sad image condition led to shallower processing and poorer engagement (i.e., lower recall, policy support and intentions to discuss) for people with a moderate (vs. low) sense of environmental identity. To this end, a new factsheet focusing on the problem of plastic pollution in the ocean was developed. To address the limitation identified in Study 4, the factsheet included information about what people can do to stop plastic pollution from entering the ocean (see Appendix G). It was predicted that the inclusion of efficacy information would weaken the negative effect evidenced in Study 4, by participants with moderate environmental identities exposed to the sad image condition.

The second aim of Study 5 was to overcome the problem identified in Study 4 with regard to the sad image not eliciting a high degree of sadness among message recipients. Specifically, the image selected for Study 5 was similar to the image used in Study 3, which depicted a turtle ingesting a plastic bag and was pre-tested to elicit a mean score of 3.57 (on a 5-point scale) for sadness. However, to ensure that any identified effects for the sad image condition were not specific to the turtle itself, a fourth image condition was included, that of a turtle with no plastic bag. It was predicted that the sad image condition would lead to higher engagement via deeper processing of the message content relative to the control condition, and the two serene image conditions (i.e., Image 1-ocean and Image 2-turtle with no plastic bag; [H1]).

The third aim was to replicate the findings from Study 4 with respect to H2a, H2b, and H3. Specifically, relative to the control condition, the serene image conditions would lead to poorer overall message engagement via depth of processing (H2a) and that there would be no significant differences between the two serene image conditions (H2b).

Finally, building on the findings from the first study in this chapter, it was predicted that the effect of the serene image conditions on depth of processing will be moderated by environmental identity (H3), such that the effects would be attenuated for moderate environmental identifiers.

4.3.1. Image pre-test for Study 5

As outlined in Figure 4.4., the original image (Image 1) was of an underwater ocean scene. This image was digitally modified to include either a turtle (Image 2) or a turtle with a plastic bag in

its mouth (Image 3). The image pre-tests were designed to confirm whether the dominant emotion elicited by Image 1 and 2 was serenity, and the dominant emotion elicited by Image 3 was sadness.

Figure 4.4. Image 1 (left, target emotion serenity), Image 2 (middle, target emotion serenity) and Image 2 (right, target emotion sadness)

Note. To avoid confusion, all images are denoted by their target emotion; Serene Image 1, Serene Image 2, Sad Image 3.

The pre-test, conducted in January and February 2018, used an Australian community sample (N = 77, 76.6% Female, M_{age} = 41.26 years, SD_{age} = 22.16 years) recruited from an online platform (www.microworkers.com.au) and a convenience sample recruited via snowballing. Participants recruited via Microworkers were paid US$1.00 for their participation. The survey was hosted on the Qualtrics platform. A 3-level between-subjects design was used, whereby each participant was asked to rate either the original ocean image or one of two digitally modified images depicting a turtle with (without) a plastic bag in its mouth. The emotion elicited was assessed using the same measures as the previous image pre-tests (see Study 4).

Due to severe departures from normality, a series of Mann-Whitney U tests tested for significant differences between the conditions (see Table 4.10). The first set of comparisons compared the emotion elicited by two serene image conditions (Image 1 and Image 2), and the second set of comparisons compared the combined serene images to the scores of the sad image condition (Image 3).

Table 4.10. Median Scores for the Quantitative Emotion measures for Image Pretest for Study 5

	Serene Image 1 (n = 24)	Serene Image 2 (n = 27)	Sad Image 3 (n = 26)	p[a]	p[b]
Joy	3.00	4.00	1.00	.049	< .001
Serenity	4.00	4.00	2.00	.165	< .001
Hope	3.00	3.00	1.00	.391	< .001
Pride	2.00	2.00	1.00	.646	< .001
Inspiration	3.00	3.00	1.00	.412	.002
Disgust	1.00	1.00	4.00	.029[c]	< .001
Distress	1.00	1.00	4.00	.173	< .001
Anger	1.00	1.00	4.00	.310	< .001
Fear	1.00	1.00	3.00	.022[c]	< .001
Sadness	1.00	1.00	4.00	.953	< .001
Indifference	1.00	1.00	1.00	.569	.786

[a] Comparing Image 1 (without turtle) and Image 2 (with turtle).
[b] Comparing the combined Image 1 and 2 groups (serene) with Image 3 (sad).
[c]Significant Mann-Whitney tests with equal medians (see UCLA: Statistical Consulting Group, n.d.) indicates that although *on average* the targets did not differ on this attribute, at the extremes, Image 2 was less disgusting/fearful than Image 1.

Comparisons of the two images designed to elicit the integral emotion of serenity revealed significant differences for joy (Image 2, with turtle, elicited greater joy than Image 1, without turtle) and disgust (Image 1 elicited greater disgust than Image 2). When comparing Image 3 (turtle with plastic bag) to the serene images combined (Image 1 and Image 2), the quantitative scores for Image 3 were higher for all negative emotions and lower for all positive emotions. No significant differences were evident with regard to feeling 'indifference'.

To assess the dominant emotion elicited by each image, a series of Wilcoxon Signed-Rank tests (with a Bonferronni corrected $\alpha = .013$) were undertaken. The findings confirmed that, for Image 1, the score for serenity was significantly higher than pride ($p = .001$) but not significantly different from hope, joy, or inspiration (ps > .016). For Image 2, however, the score for serenity was significantly higher than hope, pride, and inspiration, ps < .003, but not (using the Bonferroni adjustment) from joy ($p = .049$). With regard to the dominant negative emotion elicited by Image 3, the score for sadness was significantly higher than both distress ($p = .001$) and fear ($p = .001$) but not significantly different from disgust ($p = .495$) and anger ($p = .227$).

As with all previous pre-tests, an analysis of the open-ended qualitative responses revealed clear differences with regard to the dominant emotion elicited by each image. As can be seen from Table 4.11, a higher proportion of participants indicated that serenity or calmess was the dominant emotion elicited by the serene images (n = 20, Image 1 and n = 18, Image 2) when compared to the sad image (n = 2, Image 3). This pattern was repeated when considering all other emotions associated with certain-appraisals. Follow up tests (with a Boferronni corrected $\alpha = .017$) confirmed that for emotions associated with certain-appraisals Image 2 (turtle) scored higher than Image 3

(Turtle with plastic bag; $p = .004$) and Image 1 (no turtle) scored higher than Image 3 ($p < .001$). However, as expected, Image 1 and Image 2 were not significantly different from each other with regard to certain-appraisals ($p = .173$). Conversely, sadness was mentioned more frequently by participants who saw the sad image (Image 3; $n = 16$) in comparison to the serene images ($n = 1$, Image 1 and $n = 0$, Image 2). No other signficant differences were identified between the images, excluding anger. While Image 3 elicted signficantly higher levels of anger, the small proportion was not judged to be problematic.

Table 4.11. Qualitative Coding from Emotion Question for Image Pre-test for Study 5

	Serene Image 1 ($n = 24$)	Serene Image 2 ($n = 27$)	Sad Image 3 ($n = 26$)	*p* value
Certain-Appraisals				
Serenity	20	18	2	χ^2 (2, 77) = 32.21, $p < .001$
Positive-affect	1	8	1	
Angry	0	0	4	
Guilty	0	0	1	
Total	20	18	7	χ^2 (2, 77) = 17.51, $p < .001$
Uncertain-Appraisals				
Sadness	1	0	16	χ^2 (2, 77) = 32.63, $p < .001$
Negative-affect	0	1	0	
No Emotion	1	0	0	
Descriptive	1	0	0	

While the images evoked a range of emotions, taken together the data from the pre-test confirmed that they were suitable for use in the experimental study, as the dominant emotion elicited by Image 1 and Image 2 was serenity, whereas the dominant emotion elicited by Image 3 (turtle with plastic bag) was sadness.

4.3.2. Method

Study 5, conducted in March 2018, used a 4-level (image: no image, serene image, serene image with turtle without plastic bag, sad image of turtle with plastic bag) between-subjects design. The experimental stimulus, a factsheet about plastic pollution of the ocean was constructed specifically for the study and varied only in terms of the image used. The factsheet and survey was hosted on the online Qualtrics platform.

4.3.2.1.Participants

The data was collected using a paid on-line research panel with quotas used to ensure a relatively even balance of age and gender. A total of 659 participants were screened out and unable

to complete the survey: 646 scored higher than 5.00 on an initial environmental identity scale and 13 failed an attention check item. A further 26 participants indicated that their primary language was not English and were therefore not included in the final sample. The final sample comprised 394 participants. Participant ages ranged from 19 years to 87 years (M_{age} = 59.32, SD_{age} = 15.14). The sample consisted of a reasonably balanced gender split (54.6% male). The socio-demographics of the sample, including gender, age, education, income and home ownership, are presented in Table 4.12. Analyses indicated no significant differences for any sociodemographic variables across conditions, as expected given experimental randomisation, *p*s > .307.

Table 4.12. Individual Characteristics for Study 5 (Standard Deviations or Percentages in brackets)

	Control	Serene Image 1	Serene Image 2	Sad Image 3	Total	
Number of participants	104 (26.40)	95 (24.10)	88 (22.30)	107 (27.20)	394	
Age (Years)	60.34 (15.28)	58.16 (15.07)	58.92 (14.35)	59.87 (15.84)	59.32 (15.14)	$F(3, 390) = 0.31$, $p = .819$
Gender						
Male	59 (56.70)	49 (51.60)	48 (54.50)	59 (55.10)	215 (54.60)	χ^2 (3, N = 394) = 0.55, p = .907
Female	45 (43.30)	46 (48.40)	10 (45.50)	48 (44.90)	179 (45.40)	
Home ownership						
Rented	27 (27.00)	32 (34.00)	31 (35.60)	27 (25.50)	117 (30.20)	χ^2 (3, N = 387) = 3.48, p = .323
Owned	73 (73.00)	62 (66.00)	56 (64.40)	79 (74.50)	270 (69.80)	
Home Type (%)						
Apartment	15 (14.40)	23 (24.20)	20 (22.70)	24 (22.40)	82 (20.80)	χ^2 (3, N = 394) = 3.61, p = .307
House	89 (85.60)	72 (75.80)	68 (77.30)	83 (77.60)	312 (79.20)	
Education (%)						
School	40 (38.50)	38 (40.00)	38 (43.20)	43 (40.20)	144 (37.50)	χ^2 (6, N = 394) = 6.06, p = .417
Trade/TAFE	40 (38.50)	40 (42.10)	28 (31.80)	32 (29.90)	132 (34.40)	
University	24 (23.10)	17 (17.90)	22 (25.00)	32 (29.90)	108 (28.10)	
Income						
< AUD$49,999	46 (44.20)	44 (46.30)	45 (51.10)	53 (49.50)	188 (47.70)	χ^2 (6, N = 394) = 3.61, p = .726
AUD$50-99,999	35 (33.70)	35 (36.80)	31 (35.20)	32 (29.90)	133 (33.80)	
> AUD$100,000	23 (22.10)	16 (16.80)	12 (13.60)	22 (20.60)	73 (18.50)	

4.3.2.2. Procedure and Measures

After providing consent, participants were asked the same series of questions as outlined in Study 4. Participants were then presented with a factsheet which included information about the plastic in oceans (i.e., how much plastic is in the ocean, how does plastic get into the ocean, how does plastic affect ocean life, as well as steps that both individuals and local governments can do to help). Next, participants were randomly allocated to one of four image manipulation conditions. Participants assigned to the Serene Image 1 condition saw the factsheet with Image 1 (underwater ocean scene), while those assigned to the Serene Image 2 condition saw the same factsheet with the same oceanic image with the addition of a turtle in the picture (see Figure 4.2 left and middle images respectively). In the Sad Image 3 condition, the image was digitally manipulated to show the turtle consuming a plastic bag (see Figure 4.2, right image). Finally, participants assigned to the control condition received the same factsheet but with no embedded image.

After reading the factsheet, participants answered a series of questions assessing depth of processing, message recall, policy support, and intentions to discuss the content with others. Excluding message recall, the items were identical to the measures used in Study 4. The message recall questions were specific to the content of the factsheet. Participants responded to two true/false questions and three free-response questions (e.g., "True or False: It is estimated that more than 50 million metric tonnes of plastic waste are deposited into the ocean each year " and "The factsheet listed a number of ways in which stormwater can be filtered to remove plastic. Please list as many as you can recall."). Responses were scored as: incorrect answers (0), partially correct answers (0.5) and correct answers (1). A total message recall score was generated by summing the scores, with higher scores indicating higher levels of message recall. Means, standard deviations and reliability coefficients for all measures are described in Table 4.14.

To confirm the dominant emotion elicited by each of the image conditions (i.e., serenity or sadness) participants responded to a free-response question: "Thinking back to when you first saw the above factsheet, please indicate how it made you feel?" Participants were scored one (1) if they mentioned feeling a specific discrete emotion or a related synonym and zero (0) if they did not mention any of the target emotion words.

4.3.3. Results

4.3.3.1.Manipulation Check

Participant responses to a question assessing the most dominant emotion elicited by each of the experimental conditions can be seen in Table 4.13. Within each experimental condition, a noticeable proportion of the participants' responses were either "nothing" or descriptive response

(e.g., “informative” or “the turtle”). While there was no difference for ‘no emotion’ responses between the conditions, visible inspection of the frequencies showed that nearly twice as many people in the control condition gave a descriptive response.

Table 4.13. Qualitative Coding for the Manipulation Check for Study 5

	Serene Image 1 (n = 95)	Serene Image 2 (n = 88)	Sad Image 3 (n = 107	Control (n = 103)	p value
Certain-Appraisals					
Serenity/Calm	12	10	2	0	χ^2 (3, 394) = 21.46, p < .001
Positive Affect	8	6	2	0	
Bored	1	1	4	5	
Anger	2	3	7	2	
Shame	0	2	3	0	
Disgust	5	0	5	4	
Total	28	21	23	11	χ^2 (3, 394) = 11.35, p = .010
Uncertain-Appraisals					
Sad	20	24	46	20	χ^2 (3, 394) = 18.22, p < .001
Fear	4	0	1	2	
Negative Affect	0	2	1	2	
Worry	7	0	0	1	
Surprise	3	0	1	15	
Total	34	26	49	40	χ^2 (3, 394) = 5.64, p = .131
Interest [a]	0	3	4	7	p = .060
Nothing	11	20	12	11	χ^2 (3, 394) =7.02, p = .070
Descriptive response	22	18	19	34	χ^2 (3, 394) = 7.29, p = .063

[a] Fischer’s Exact test reported as four cells had an expected count < 5.

With regard to the target emotion of serenity, a significant difference between the conditions was found. Follow-up tests (with a Bonferroni corrected α = .017) confirmed that there was no difference between the two serene image conditions (p = .792), and that the proportion of participants who mentioned serenity or calmness in the combined serene image conditions was significantly higher compared to the sad image condition (p = .002) and the control condition (p < .001). With regard to the total proportion of participants that nominated emotions associated with a certain-appraisal (including serenity and positive affect, which are predicted to have the same effect on depth of processing), follow-up tests (with a Bonferroni corrected α = .017) confirmed that there was no difference between the two serene image conditions (p = .450). However, contrary to what was expected, there was no significant difference between the collapsed serene image conditions and the sad image condition (p = .048). There was, however, a significant difference between the collapsed serene image conditions and the control condition (p = .001).

Significant differences between the conditions were also identified for the target emotion of sadness. Follow-up tests (with a Bonferroni corrected $\alpha = .017$) confirmed that sadness was reported more frequently in the sad image condition when compared to the control condition ($p < .001$); the serene image 1 (no turtle) condition ($p = .001$); and the serene image 2 (turtle with no plastic bag) condition ($p = .015$). A more detailed analysis of the manipulation check items revealed no significant difference between the image conditions with regard to the proportion of participants that nominated emotions associated with an uncertain cognitive appraisal (i.e., sadness and negative affect, which are predicted to all have the same effect on depth of processing). While the difference in sadness is in line with the aim of the manipulation, the lack of an overall effect in emotions associated with uncertainty raises concerns, since it has been argued that it is the relevant associative cognitive appraisal (i.e., certain or uncertain) that motivates or demotivates depth of processing not the actual discrete emotion itself (Tiedens & Linton, 2001). Furthermore, while more participants nominated sadness in the sad image condition compared to the other conditions, within each of the other conditions, sadness was nominated more frequently than any other emotion.

In summary, the manipulation check suggests that while there were significant differences between the image conditions with regard to the target emotions of sadness and serenity, the image conditions failed to elicit differences in the desired cognitive appraisals (i.e., certainty in the serene image conditions and uncertainty in the sad image condition), and sadness was the dominant emotion across all four conditions. However, the image pre-test demonstrated that the expected differences between the conditions existed. Participants were asked the manipulation check at the end of the main study survey, after they had cognitively processed the information and after they had completed all of the dependent variable questions. Therefore, the participants' responses to the manipulation check would have been influenced by the cognitive processing that has occurred in between their initial emotional reaction to the image and accompanying text, and when they were asked the manipulation check question 5-10 minutes later.

4.3.3.2.Focal Experiment

The frequency of missing data was less than 5% for all variables (Tabachnick & Fidell, 2007). Ten univariate outliers (> 3 *SD*s) on the environmental identity scale were identified and winsorised (Field, 2013). No multivariate outliers were detected using Mahalanobis Distance ($p > .001$; Tabachnick & Fidell, 2007).

First, three orthogonal contrasts or weighted effect codes were created: the first compared the control and combined serene image conditions to the sad image condition (X_1: Sad Image = -.75, Control = .25, Serene Image A = .25, Serene Image B = .25). The second compared the combined serene images to the control condition (X_2: Sad Image = 0, Control = -.67, Serene Image 1 = .33, Serene Image 2 = .33) and the final compared the two serene images to each other (X_3: Sad

Image = 0, Control = 0, Serene Image 1 = -.50, Serene Image 2 = .50). Table 4.12 presents the zero-order correlations, means, and standard deviations. At the zero-order level, the independent variables (X_1, X_2 and X_3) were not correlated with any of the outcome variables. Environmental identity and depth of processing were positively correlated with all dependent variables. All dependent variables were positively associated with each other, excluding policy support (maximum cost) and recall of factsheet content.

As can be seen in Table 4.15, contrary to what was expected, the overall index of moderated mediation was not significant for any of the tested models. While depth of processing was strongly predictive of each of the dependent variables, it did not vary as a function of the image conditions, and environmental identity did not moderate the indirect effects. Therefore, no support for any hypothesised effects was observed. Furthermore, additional analyses to confirm whether differences in socio-demographic variables between this and previous samples were acting as moderators were also not significant.

Table 4.14. Means, Standard Deviations, Correlations and Reliability Co-efficients for Study 2

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
1. Age	-														
2. Gender (Male = 0, Female = 1)	.36**	-													
3. Education (1-5)	.10	-.09	-												
4. Income (1-12)	.30**	.05	.25**	-											
5. Previous knowledge (1-5)	-.25**	-.31**	.12*	-.07	-										
6. Environmental Identity (1-7)	-.04	.06	.06	.03	.03	-									
7. Depth of processing (1-7)	.05	.16**	-.04	.06	.03	.29**	-								
8. Recall (0-10)	.00	.07	-.03	.02	-.05	.12*	.43**	-							
9. Policy support (no cost; 1-5)	-.07	-.01	-.03	.05	-.03	.22**	.43**	.39**	-						
10. Policy support (min. cost; 1-5)	.06	.11*	.10*	.13*	-.13**	.23**	.37**	.26**	.35**	-					
11. Policy support (max. cost; 1-5)	.15**	.07	.11*	.12*	-.06	.14**	.14**	0.08	.12*	.66**	-				
12. Intentions to discuss (1-7)	.00	.13**	-.15**	.04	.10*	.39**	.62**	.22**	.30**	.36**	.30**	-			
13. X_1	.04	.03	.01	-.04	-.00	-.00	.05	-0.02	-0.08	.03	.07	.03	-		
14. X_2	-.01	.02	-.07	-.03	.10	.06	.08	0.00	0.09	.04	.04	.08	-.04	-	
15. X_3	-.03	-.02	.02	-.01	.09	-.03	.02	0.03	0.03	-.02	.07	-.04	-.02	-.02	-
Mean	59.32	0.45	2.89	4.89	1.92	4.24	5.13	3.97	4.45	3.33	2.17	4.10	-.01	-.03	-.01
SD	15.14	0.50	0.95	3.76	0.87	0.91	1.09	1.84	0.79	1.18	1.09	1.26	.44	.41	.34
Reliability (α)	-	-	-	-	-	.92	.95	-	-	-	-	.95	-	-	-

Note. * $p < .05$, ** $p < .01$.

Table 4.15. Condition Process Analysis for Study 5

Variables	Depth of Processing			Recall			Policy support (No cost)			Policy support (Minimal cost)			Policy support (Maximum cost)			Intentions to discuss		
	B	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*
X_1	.08	.12	.481	-.05	.19	.810	.16	.08	.460	.07	.12	.556	.06	.12	.630	.03	.11	.777
X_2	.16	.13	.202	-.19	.21	.353	-.11	.09	.203	.06	.13	.650	.21	.13	.104	.03	.12	.789
X_3	.09	.15	.546	.13	.25	.605	.06	.11	.553	-.04	.16	.806	.25	.16	.111	-.19	.15	.195
Age (Years)	.00	.00	.782	-.00	.01	.551	-.00	.00	.075	-.00	.00	.534	.01	.00	.086	-.00	.00	.634
Gender	**.34**	**.12**	**.004**	-.05	.19	.808	-.12	.08	.126	.03	.12	.794	.01	.12	.954	.17	.11	.126
Education	-.08	.06	.154	-.01	.09	.929	-.01	.04	.890	**.15**	**.06**	**.011**	.11	.06	.071	**-.19**	**.05**	**.001**
Income	.02	.02	.119	.00	.02	.998	.01	.01	.381	.02	.02	.160	.02	.02	.233	.02	.01	.218
Previous knowledge	.08	.07	.202	-.14	.11	.177	-.08	.04	.057	**-.22**	**.07**	**.002**	-.06	.07	.335	**.18**	**.06**	**.003**
EI	**.35**	**.06**	**.000**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
X_1 x EI	.15	.12	.216	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
X_2 x EI	-.18	.15	.233	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
X_3 x EI	-.21	.17	.228	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Depth of processing				**.74**	**.08**	**.000**	**.32**	**.03**	**.000**	**.40**	**.05**	**.000**	**.12**	**.05**	**.013**	**.69**	**.05**	**.000**
IMM X_1				Index = .11, *SE* = .15, 95% *CI* = -.1548, .4511			Index = .04, *SE* = .06, 95% *CI* = -.0723, .1805			Index = .06, *SE* = .08, 95% *CI* = -.0819, .2393			Index = .01, *SE* = .03, 95% *CI* = -.0201, .1023			Index = .10, *SE* = .13, 95% *CI* = -.1612, .3696		
IMM X_2				Index = -.13, *SE* = .17, 95% *CI* = -.4566, .2190			Index = -.06, *SE* = .07, 95% *CI* = -.1959, .0943			Index = -.07, *SE* = .09, 95% *CI* = -.2440, .1203			Index = -.02, *SE* = .03, 95% *CI* = -.0970, .0372			Index = -.12, *SE* = .15, 95% *CI* = -.4076, .2021		
IMM X_3				Index = -.16, *SE* = .18, 95% *CI* = -.5368, .1858			Index = -.07, *SE* = .08, 95% *CI* = -.2197, .0808			Index = -.08, *SE* = .10, 95% *CI* = -.2709, .1075			Index = -.03, *SE* = .3, 95% *CI* = -.1014, .0368			Index = -.14, *SE* = .16, 95% *CI* = -.4607, .1823		
Model Summary	R^2 = .13, F(12,381) = 4.92, p < .001			R^2 = .19, F(9,384) = 10.27, p < .001			R^2 = .21, F(9,384) = 11.61, p < .001			R^2 = .18, F(9,384) = 9.36, p < .001			R^2 = .66, F(9,384) = 2.99, p = .002			R^2 = .41, F(9,384) = 30.04, p < .001		

Note. EI = Environmental Identity. *SE* = Standard Error. IMM = Index of Moderated Mediation.

4.3.4. Discussion

The aim of Study 5 was to replicate and extend on the results of Study 4, which found that serenity was associated with reduced depth of processing for low environmental identifiers. Study 4 also indicated that at moderate levels of environmental identity, eliciting sadness could reduce depth of processing and message engagement if the information does not meet the motivation goal of the elicited emotion, in this instance, a reduction in sadness/uncertainty. Therefore, a new factsheet was designed which presented novel information about plastic pollution and included information about steps that could be taken to address the problems raised by the factsheet (i.e., how to reduce the amount of plastic in the ocean). A final aim of Study 5 was to use an image that elicited a higher degree of sadness for the sad image condition.

Contrary to what was predicted however, there were no differences between the three image conditions with regard to participants reporting emotions associated with certain nor uncertain cognitive appraisals. Furthermore, for all of the image conditions, participants more often nominated sadness as the dominant emotion elicited. Despite the failed manipulation check, the planned analyses were conducted because the image pre-test suggested the efficacy of the manipulation. However, no support for the proposed moderated mediation model was found. That is, the results suggest that the image conditions did not directly influence depth of processing and they were not moderated by environmental identity, and depth of processing did not mediate the relationship between the image conditions and overall engagement with the message topic. In other words, while depth of processing was still strongly predictive of overall engagement, depth of processing did not vary as a function of the image conditions.

One likely explanation for the non-significant results was the specific topic and content of the factsheet used in this study (see Appendix G), which differed from that used in Studies 2 and 3 (Chapter 3) and Study 4. Specifically, the previous factsheets were about the more generic topic of stormwater management (see Appendix E and F), whereas the Study 5 factsheet focused on ocean plastic pollution. The volume of plastic in our oceans and the effect plastic has on ocean and animal health was highly topical in Australia (where the survey was conducted) at the time the data was collected. A search of Google Trends indicated that Australian residents' interest in "plastic in oceans" was on a steep upward trajectory at the time the survey was conducted in early March 2018 (Interest over time[15] = 76*)* and that it peaked just one week after the survey concluded (Interest over time = 100; Google, 2018). This interest was likely related to increased media coverage, as a

[15] Interest over time is a metric used by Google Trends (https://trends.google.com/trends/?geo=) to represent interest relative to the highest point on the chart for the given region and time. A value of 100 represents peak popularly for a term.

number of governments (including Queensland, Victoria, and Western Australia) had recently introduced plastic bag bans (Kilvert, 2018, April 18).

Despite the survey targeting people that did not identify strongly with environmental issues, the qualitative responses from participants indicated a high level of personal involvement in this topic. Specifically, at survey completion, participants were asked, "If you would like to make any comments about this survey, or about the topic of stormwater management in general, please do so here". In previous studies, few participants provided specific feedback on either the survey or topic. However, for this study, close to 25% of the participants took the opportunity to leave detailed comments. The comments indicated that participants felt that this topic was both topical (e.g., "Like the way some councils are managing their stormwater run-off. Pity not all councils are doing it." and "I thought the Government was going to ban plastic bags this year" and "A very pertinent argument") and personally relevant (e.g., "I think it is important that people are made aware of where refuse ends up if discarded in stormwater outlets" and "Definitely got me thinking about my own responsibilities towards the issue" and "It was a very thought provoking survey and has made me think more about what I can do").

It appears likely that the high level of personal relevance with regard to the topic of plastic ocean pollution led to the participants having a higher motivation to process the message topic, regardless of the embedded image. In this respect, the findings are similar to those found for high environmental identifiers in Studies 2 and 3. Taken together, the findings suggest that emotions serve as a peripheral cue for depth of processing but only under lower levels of involvement. This notion is consistent with a wide body of research evidencing personal involvement with the topic as the strongest predictor of central processing and under such situations the written content of the message, rather than peripheral cues (in this study, the emotions elicited by images), will have the strongest influence on subsequent engagement (i.e., recall, attitudes and behaviors; Petty & Cacioppo, 1986). In the current study, the written/textual content of the message was *identical* across the conditions. In sum, it is likely that the topic was personally relevant to participants and, in light of this, the results of Study 5 are perhaps unsurprising.

Future research would benefit from using a more specific measure of involvement with the topic, rather than the more generic measure of strength of environmental identity. Future research would also benefit from explicitly manipulating the provision of efficacy-relevant information to test its possible role in changing the impact of image-based emotions, and from conducting a pre-test of all the visual elements of the factsheet (i.e., image, heading and text) to gain a more accurate measure of the integral emotion elicited upon first glance.

4.4. General Discussion

The two studies described in this chapter aimed to assess the causal effect of images that elicit integral serenity on depth of processing, as well as overall message engagement, in comparison to an image that elicited sadness and to a control condition that included no image. Although environmental identity was not predicted to moderate the relationship between image conditions and depth of processing, the post-hoc analyses undertaken in Study 4 showed that it did indeed act as a moderator (i.e., differences were evident between low and moderate environmental identifiers) and therefore its moderating role was explored further in Study 4.

With regard to participants with lower environmental identities, the results of Study 4 replicated the results of the studies described in Chapter 3. Consistent with past research (Tiedens & Linton, 2001), images that elicited emotions that were associated with a cognitive appraisal of certainty led participants to lower their depth of processing compared to images that elicited emotions that were associated with uncertain cognitive appraisals (i.e., sadness) and compared to a control condition that included no image. Furthermore, the sad image condition did not increase depth of processing relative to the control group for participants with low environmental identities, also replicating what was found in Study 3 (Chapter 3).

However, for participants with stronger (i.e., moderate) environmental identities, in Study 4, the sad image condition lead to lower overall engagement with the message topic (i.e., lower recall, lower policy support with no or minimal cost implications as well as lower intentions to discuss content with others) via depth of processing. This finding aligns with literature indicating that the exclusion of information that could address the motivation goals associated with sadness (i.e., to cope with a sense of loss) might lead to backlash effects (Dillard & Nabi, 2006; Nabi, 1999). As has been demonstrated in both fear appeal research (Witte & Allen, 2000) and the motivated processing literature (Dillard & Nabi, 2006; Nabi, 1999), an emotion's impact is linked to the recipients' sense of self-efficacy. Therefore the absence of information to help participants cope with the loss associated with the elicitation of sadness may have led participants in the sad image condition to disengage; thus lowering their depth of processing and subsequent levels of message engagement (i.e., poorer recall, policy support and intentions to discuss).

While Study 5 was designed to both re-test and address some of the questions raised by Study 4, the images did not influence depth of processing, and support for the proposed moderated mediation model was not found. That is, while depth of processing was still strongly predictive of overall engagement, depth of processing did not vary as a function of the image conditions. The lack of significant findings was likely due to the specific topic of the factsheet (i.e., plastic pollution in oceans). Given the fact that plastic bag bans were being introduced across much of Australia at the time the survey data was being collected (Kilvert, 2018, April 18), the personal relevance of the

topic may have been greatly increased in Study 5 compared to the previous studies. This was evidenced in both the qualitative comments of the sample, and a google search trend analysis of the wider Australian population (Ref). Therefore, the results of Study 5 were consistent with the view that emotions serve as a peripheral cue for depth of processing *only* under conditions of low personal relevance. When messages are perceived as personally relevant, recipients will be motivated to use the central path, and it is the content of the message (which was identical across all four conditions) that will have the strongest influence on subsequent engagement (i.e., knowledge, attitudes and behaviors (Petty & Cacioppo, 1986).

4.5. Conclusion

To the best of the researcher's knowledge, this is the first study to demonstrate that serene and sad images can negatively influence affective, cognitive and behavioural engagement through depth of processing for different segments of the population. Moreover, these effects appear to be dependent on the content of the message. Specifically, in line with the findings described in Chapter 3, the selection of images used to accompany written messages matters for people with low levels of environmental identity to engage with pro-environmental messages. That is, embedding serenity-inducing images within messages about sustainable urban stormwater management had a detrimental effect for people who did not have a strong environmental identity. The research also suggests that when people have moderate to high levels of environmental identity (Study 4) or when the message is highly topical (Study 5), the selection of images will not influence depth of processing nor message engagement, as long as the message content included information in line with the motivational goal of the message. At a practical level, the findings suggest that, if a communication message is likely to elicit sadness, it is important to include efficacy information that allows the recipients to address and overcome the feeling of sadness. Taken together, the variability of the findings also highlights the role of contextual factors in driving engagement with environmental messaging. While such variability creates logistical and interpretative challenges for scholarly research and publication, engaging with contextual shifts in issue salience or other factors that moderate the impact of integral emotions and environmental identity on depth of processing and engagement is likely to be theoretically generative in future.

CHAPTER 5

5. Introduction

Chapters 2 - 4 presented the results of a Q-sort study (Study 1) and four experimental studies (Study 2-5) and outlined whether the hypotheses from each study were supported or not. The current chapter concludes the thesis by discussing the results in light of the original research questions, as well as describing the research's empirical and theoretical implications. It also lists the strengths and limitations of the research, and discusses future research opportunities.

To date, no research has explored the role of images or emotions in relation to engagement with sustainable urban stormwater management initiatives. Therefore, a key objective of this research was to identify the types of images that are commonly used in relation to this environmental topic (i.e., sustainable urban stormwater management) and how those images varied in salience according to three factors thought to influence image engagement: emotions, topic congruence and personal relevance (addressed in Study 1). Moreover, despite the prevalence of emotive images accompanying environmental messages, research has only begun to assess the effect of integral discrete emotions on message processing, and has all but ignored the role of images as an antecedent to the emotion felt. By drawing on the ELM and the appraisal-tendency framework, the thesis included experimental research that investigated the causal influence of discrete, integral emotive images on depth of processing of an accompanying message and, in turn, overall engagement with the message topic (Studies 2-5). Finally, the research assessed the moderating role of personal relevance (as measured by strength of environmental identity, Studies 2-5).

5.1. Summary of findings

In response to Research Question 1a, Study 1 assessed community members' responses to categories of images across three key factors that can influence image engagement: emotions, topic congruence and personal relevance. An audit of community-facing communication about sustainable urban stormwater management identified a wide variety of image types that had been employed. The most common images were of traditional stormwater infrastructure, new stormwater management initiatives, flood events, and ocean environments.

Research Question 1b asked which emotions were elicited by the different categories of images, and whether the images were considered relevant to the context and/or personally relevant. Further, Research Question 1c asked the degree to which community members' responses were consistent. The Q-method study found that images of pristine ocean environments consistently elicited positive emotions (i.e., serenity and happiness). However, the majority of participants did not perceive such images as relevant to the topic, and the responses with regard to personal relevance were highly varied. Images of traditional stormwater infrastructure consistently evoked

negative emotions (disgust specifically), and were perceived as relevant to the topic by all participants. They were, however, among the lowest ranked images in terms of personal relevance. Although images of flooding were consistently above the mid-point for personal relevance and relevance to the topic and elicited an emotional response, the type of emotion elicited varied. That is, the images elicited a positive emotion (i.e., pride) for the majority of participants, but sadness for the minority. This emotional ambivalence likely arises out of recent experiences in the local area, which saw the tragedy for some of loss of property, livelihood, and life itself, alongside a widespread, empowering community mobilisation that many citizens participated in, to assist neighbours in the aftermath of the flooding (Adams, 2016, 14 January). Images of more recent stormwater management innovations, such as raingardens and greenwalls, were consistently ranked around the midpoint in terms of emotional connection, topic congruence and personal relevance. That is, they failed to elicit any sort of emotional reaction from the participants (either positive or negative). Indeed, they were not seen as being highly personally relevant and participants did not understand their relevance to the topic of urban stormwater management.

The research in Chapter 2 takes an important first step. However, the Q-sort analyses were not able to assess the causal effects of the images on message engagement. Furthermore, past research has shown that discrete emotions matter in terms of message processing and engagement. Specifically, research by Tiedens and Linton (2001) has established that discrete emotions that are associated with the cognitive appraisal of certainty (e.g., disgust and serenity) lead people to lower their depth of processing, whereas discrete emotions that are associated with the cognitive appraisal of uncertainty (e.g., sadness) lead people to increase their depth of processing. However, this past research has focused on the influence of unrelated or incidental emotions (Isbell et al., 2016; Lerner et al., 2015) and has largely ignored the role of emotive images and integral emotion, despite the ubiquitous use of emotive related images in communications (Hart & Feldman, 2016; Wozniak et al., 2015). Therefore, it is important to establish whether these past findings generalise to message-relevant emotions elicited by images embedded within environmental communication messages (Isbell et al., 2016; Lerner et al., 2015; Loewenstein & Lerner, 2003).

Addressing the above identified research gap was the focus of Research Questions 2 and 3. Specifically, Research Question 2 asked whether different discrete emotions, elicited by images embedded into a related written communication about sustainable urban stormwater management, would influence depth of processing and subsequent message engagement. Research Question 3 asked whether this effect would be moderated by the personal relevance of the message (as measured by strength of environmental identity).

Studies 2-4 showed that images eliciting emotions associated with certain-appraisals (i.e., predominantly disgust and serenity) lower the depth at which the accompanying written information

is processed, relative to experimental conditions with images eliciting sadness (which is associated with an 'uncertain' cognitive appraisal) and a control condition without an image. The findings are in line with past research on the effect of incidental emotions (Bodenhausen, Sheppard, et al., 1994; Griskevicius et al., 2010; Lerner et al., 2004; Tiedens & Linton, 2001). Furthermore, this effect of images on depth of processing was shown to be moderated by personal relevance. That is, images eliciting either disgust or serenity only reduce depth of processing for those participants with lower levels of environmental identity; this pattern did not emerge for those with stronger environmental identities (i.e., moderate or high environmental identities; Studies 2-4). The null findings from Study 5 are consistent with the notion that the effect of certain emotions on depth of processing may not emerge when the topic is highly personally relevant. Support for this contention comes from previous research showing that the most influential factor motivating depth of processing is the degree to which the message is personally relevant to the message recipient (Petty et al., 1983; Petty & Wegener, 1998). Moreover, prior research suggests that emotions serve as a peripheral cue to guide depth of processing under conditions of low personal relevance (Petty & Briñol, 2015).

Contrary to what was predicted in Studies 3-5, embedding an image known to elicit sadness into a factsheet did not increase depth of processing over and above that of a factsheet with no embedded image. As noted previously, one potential explanation is that the control baseline condition was not 'neutral' in that it consistently evoked the dominant discrete emotion of 'interest'. As such, the emotion of interest may have raised the depth of processing among the control group enough to have washed out the effects of the sad image condition (i.e., the control condition performed equivalently to the sad image condition). Although this finding was unexpected, the idea that 'interest' could motivate deeper processing has strong face validity. Specifically, interest is defined as "the feeling of wanting to know or learn about something or someone" (Oxford Dictionary of English, 2018). As such, the research described in this thesis does not contradict past research, which shows that sadness leads to deeper message processing (Bodenhausen, Sheppard, et al., 1994; Small & Lerner, 2008; Tiedens & Linton, 2001), just that it does not increase depth of processing over and above a feeling of 'interest'. Future research might consider the use of alternative control conditions, which are designed around more mundane topics so as not to evoke interest, albeit that such an approach may be of lesser interest for practitioners seeking to evaluate the conditions under which well-crafted written information is received most readily.

It is important to note that a negative effect for sadness may also occur when the message (communication topic) is more personally relevant to the recipient. That is, for people with comparatively stronger environmental identities, sadness did not serve as a peripheral cue but rather motivated them to process the content more deeply. This effect is likely to emanate from the desire to resolve or address the feeling of sadness (Nabi, 2003). If the written message does not contain

response cues (i.e., self-efficacy information) to help the recipient cope with the feeling of sadness, then a negative effect can occur, such that people are demotivated to process the message and this can lead to poor engagement as measured by recall, policy support and intentions to discuss. This pattern of results appeared to occur in Study 4, and is consistent with research on fear appeals, which shows that it is important that the message content not only describes the problem but also emphasises the solutions to address the feeling of fear (Witte & Allen, 2000). Manipulating self-efficacy orthogonally to emotion induction may be an interesting direction for future research that would allow this explanation to be tested in relation to other emotions than fear.

Finally, in response to Research Question 4, the results of the thesis confirmed that depth of processing indirectly mediates the effect of emotive images on overall cognitive, affective and behavioural engagement. That is, the level of attention and focus given by message recipients to the message content is strongly predictive of the degree to which they recall the content, how supportive they are of remedial policy initiatives (predominantly when those initiatives have small financial implications), and how willing they are to discuss the message content with friends and family. This is in line with past research indicating that higher levels of message processing are associated with improved recall of message arguments (Bok & Min, 2013; Nabi, 2003; Smith & Shaffer, 2000), higher levels of attitudinal support (Meijnders et al., 2001; Nabi, 1999, 2002), and are a stronger predictor of behaviour and/or behavioural intentions (Petty & Cacioppo, 1986).

5.2. Theoretical & practical implications

The proposed research contributes to the fields of social and environmental psychology on several fronts. Despite over three decades of research exploring the role of incidental affect and more recent research exploring the role of incidental discrete emotions, it was unclear whether this research would translate to integral discrete emotions. The thesis research therefore extends the theoretical framework of emotion and cognition (i.e., the ELM and the appraisal-tendency framework) to provide some of the first evidence to show that past research on the effect of incidental emotions on depth of processing translates to integral emotions (for other examples see Meijnders et al., 2001; Nabi, 2002). This is important because people regularly experience integral emotions in response to communications. As such, studying integral emotions experimentally is key to understanding how such emotions can influence message engagement in the real world.

The research also demonstrates that discrete emotions of the same valence (e.g., disgust and sadness) have differential effects on depth of processing (Bodenhausen, Sheppard, et al., 1994; Tiedens & Linton, 2001). Therefore, the research supports the more recent efforts of scholars to move past valence based approaches that fail to differentiate between different discrete emotions. Instead, the studies described in this thesis support an appraisal-dimension approach, as first advocated by Tiedens and Linton (2001). That is, the degree to which the message recipient's initial

cognitive appraisal of the emotion varies with regard to the dimension of 'certainty' is associated with differing effects on depth of processing. Emotions such as sadness (a low certainty emotion) may lead to more central processing, whereas emotions such as disgust and serenity (high certainty emotions) lead to more peripheral processing, albeit only when the context of the information is not personally relevant to the viewer (see Study 2-4).

Moreover, the thesis examined a discrete positive emotion (serenity), thus making a novel contribution to the literature. Comparatively little research to date has explored the effects of either integral or incidental positive emotions beyond happiness on depth of processing.

Although the Study 4 finding, which suggests that feeling serene leads to shallower processing, could be taken as support for the notion that positive affect leads to lower depth of processing (see Petty & Cacioppo, 1986; Schwarz & Bless, 1991; Schwarz & Clore, 1983), it should not be taken as evidence in support of affect-valence approaches. The reason for this is that not all positive emotions produce the same effects on depth of processing (Griskevicius et al., 2010). For example, the emotions of awe and nurturing love have been shown to lead to more careful consideration of the message text (Griskevicius et al., 2010). Rather, the findings from Study 4 suggests that serenity influences depth of processing in line with an Appraisal-Tendency Framework. That is, discrete emotions categorised as having 'certain' cognitive appraisals lead to shallower message processing.

In line with Petty and Briñol (2015), the findings presented in this thesis suggest that the emotions (i.e., disgust and serenity) elicited by the image only influence depth of processing when individuals perceive the topic to have low personal relevance to them. That is, the emotion elicited by an image serves as a heuristic to guide depth of processing when the recipient of the message has no pre-existing motivation to process the message contents deeply. Therefore, one way to potentially minimise this effect is to increase the personal relevance of the message. This may be achieved, for example, by reducing the psychological distance between the message and the message recipient, either temporally, spatially or socially (Leviston et al., 2014; Spence & Pidgeon, 2010).

The research also extends the literature by testing images as the antecedents to a felt emotion: an effect that has largely been ignored in past research despite the fact that images are ubiquitous in communications and their use can only be expected to increase with the growth of new media. One interesting aspect of the thesis research was that, although images were found to elicit a dominant emotion, they also elicited other emotions. This suggests that people's responses reflect a more complex emotional response than past research has suggested. For example, disgust and anger were commonly aroused in conjunction with exposure to damaged environments, and serenity and joy were co-varying responses to natural beauty. This notion of co-varying emotions is expanded on below, but as a general point, these different discrete emotions may be associated with quite distinct

cognitive appraisals and behavioural reactions. As such, the role of images in evoking an array of complex emotions and resolving the, sometimes, contradictory predictions on depth of processing needs more theoretical attention.

Historically, emotion research has often sought to simplify the study of discrete emotions or to consider only broad categories of affect (e.g., positive and negative affect; Schwarz et al., 1991; Schwarz & Clore, 1983). There has also been a tendency to simplify the stimulus arrays (Angie et al., 2011). As such, examining how complex stimuli evoke emotional ambivalence or emotional complexity affords a rich avenue for future research, particularly as respondents engage with novel or complex new topics. The present studies take initial steps into this new theoretical ground.

At a more applied level, the research presented in this thesis answers a call for further research examining the role of images in engaging people with pro-environmental communications (Braasch, 2013; Domke et al., 2002; Hart & Feldman, 2016) and extends the nascent research in this area to the previously unexplored context of sustainable urban stormwater management. The thesis research therefore represents a novel integration of theory to address the critical real-world issue of engagement with communication materials about an important environmental issue. Only one other study (see Hart & Feldman, 2016) has experimentally examined the role of images and text together in a pro-environmental context. Further, the presented studies represent the only research to date extending pro-environmental image research to a context outside of climate change communication. Taken together, the presented findings not only provide the first evidence of how sustainable urban stormwater management images are perceived and comprehended by community members but also provide insights into the causal impact of some of those images on how people process accompanying messages and their overall engagement with the message content.

Most importantly, the research shows that not all images are created equal and that some images can have a detrimental effect on the degree to which people will pay attention to the message and in turn, the degree to which they will be engaged with the message content. Accordingly, practitioners need to be careful in selecting images when creating communication messages for the wider public. This is especially true when appealing to groups that have no pre-existing interest or involvement in the communication topic, who are often the target of such communication campaigns. In the presented research, images that elicited emotions associated with ‘certain’ cognitive appraisals (i.e., disgust and serenity) appeared to lead to further disengagement with the topic among such target individuals, contrary to the intended purpose of the information flyer or website.

5.3. Limitations and future directions

The present thesis research has several limitations. First, while the study findings suggest that past research on incidental emotions translates to integral emotions, it is important to test this assumption on a wider range of emotional states, beyond disgust, sadness, and serenity. In

particular, as only one positive emotion (serenity) was examined, future research is needed to see if the findings generalise to a broader range of positive emotional states (e.g., pride, hope and awe.

Second, the current findings suggest that images do not elicit 'pure' emotions but rather a mix of emotions. That is, while the images used in the experimental manipulations successfully elicited the target emotion as the "dominant" emotion, they also elicited more than one emotion. As such, the individual contribution of each emotion could not be identified; a limitation that is likely evident in most emotion manipulation research and one that is hard to address. To illustrate this problem, Dillard, Plotnick, Godbold, Freimuth, and Edgar (1996) examined the degree to which 31 different fear appeals (used in the context of AIDS public service announcements) elicited not just fear but other discrete emotions as well. The study found that all but one announcement evoked changes in discrete emotions in addition to fear (e.g., anger and guilt). Unfortunately, most past research has not included measures of emotions beyond the target emotions, or included open-ended self-report measures. As noted earlier, future research should consider and test the influence of mixed emotions. The research described in this thesis suggests that drawing on the Appraisal-Tendency Framework would be advantageous in the study of mixed emotions as it clarifies how different discrete emotions might have different/similar cognitive appraisals that lead to different responses. That is, clustering emotions based on whether they linked to certain or uncertain appraisal dimensions could be a way to explore the effects of mixed emotions on message processing and subsequent engagement.

When assessing the role of mixed emotions, it is also important to consider the role of emotions that differ with regard to more than one appraisal dimension. For example, disgust and sadness not only sit at opposite ends of the certain appraisal dimensions, but also the degree to which the situation is perceived to be controlled by the self (i.e., disgust) or the situation (i.e., sadness). It is feasible that the cognitive appraisal of 'certainty' does not account for all the variability in considering the effects of different discrete emotions on message processing. For example, Griskevicius et al. (2010) successfully used a functional-evolutionary approach to assess the role of discrete, incidental positive emotions (e.g., love, amusement and awe) in message processing. It is possible that other factors also exert independent effects or that different emotions may influence processing through different mechanisms. For instance, the relevance of alternative emotion dimensions such as approach/avoid (Carver & Harmon-Jones, 2009) and arousal (Bissing-Olson, 2015) to depth of processing both have strong face validity and have not been previously tested. As such, future research should examine these other dimensions, and their interactions, to test whether they provide a better explanation of the findings described in this thesis or explain additional variance.

The generalisability of the findings in the present thesis is also limited by the use of a single topic/content (i.e., sustainable urban stormwater management). It is conceivable that the effects of emotions could differ across different contexts (So et al., 2015). For example, fear has been known to cause cognitive/emotional/physical 'freezing' in some contexts and flight in others (Dillard & Shen, 2006). Future research is therefore needed to investigate whether similar effects will occur across different types of contexts, as well as different types of communication media (e.g., newspaper articles, websites, social media). In the present research, images elicited emotion in the context of participants being exposed to specific persuasive information presented in a factsheet format in a broader survey. A more common function of images (especially in the era of social media) is to attract or arrest attention, as multiple stories or sources compete for participants' time. Yet, it is not known whether the images that are most likely to capture attention in relation to a particular message may sometimes then distract from processing the persuasive text. For example, does a serene ocean image attract some readers to a text, but also demotivate them from engaging in deep processing of the topic matter? Study 4 suggests this may be the case.

A broader point is that, while experiments allow for more control, they also limit the ecological validity of the study, and introduce demand characteristics that could have influenced the results of the study. For example, participants, as part of a research panel, were given instructions and incentives to attend to the information provided. It is therefore possible the presented results will have limited generalisability to real world situations where individuals are often presented with a choice in terms of which messages they will and will not attend to. Further research should attempt to mimic more closely situations whereby participants are able to choose between competing messages to gauge the extent to which the results presented here will generalise to more realistic situations.

The results of Study 5, which indicated that images that elicit sadness can result in a negative effect for those participants who have stronger environmental identities, can be explained by drawing on the fear appeal literature. That is, when the message is more personally relevant, the recipient moves away from being guided in their processing by the emotion that was elicited as a peripheral cue. Instead, the likelihood that sadness will lead to higher engagement with the message content is dependent on the degree to which the message provides goal-relevant information that will help alleviate the feeling of sadness (i.e., the extent the message provides actions one can undertake to cope with the sense of loss elicited by sadness). In the context of this study, the efficacy-related information thought to be missing was actions that individuals and/or governments can do to help limit the negative impacts of stormwater. However, as research on the role of efficacy information in domains beyond fear is sparse and the effect of efficacy information for sadness was not hypothesised a priori for Study 4. Therefore, examining the role of efficacy

requires further empirical investigation. This is the more so because when efficacy-relevant information was introduced in Study 5, it appeared to drown out the impact of the manipulations, rather than providing a context where sadness-eliciting images functioned to generate deeper processing of the information and subsequent intentions to act. It is also possible that in Study 5, the text concerning plastics in the oceans simply made all of the participants sad, dominating the impact of any emotions generated by the images. The contingencies that moderate the impact of emotions from images, and the methods that can operationalise these, are still being identified.

The focus of this research was on simple, direct images (i.e., photographs). The decision to focus on this particular type of visual image was deliberate given the ubiquity of photographic images in the wider media and the lack of experimental research exploring their use. However, other forms of images (e.g., maps, cartoons, art, and infographics) are also important for environmental communication and are equally under-researched. To illustrate, a study by Lazard and Atkinson (2015), which also used the ELM as a theoretical framework for understanding the role of visual information on depth of processing, found that infographics lead to increased central processing of message content which in turn can increase engagement with a climate change message. Lazard and Atkinson's finding demonstrates that other visual media, beyond images, hold opportunities for improving the communication of environmental topics and are, therefore, worthy of further investigation.

Last, future research should assess boundary conditions to the identified effects. A good place to start is the degree to which individual differences moderate the effects of emotions on depth of processing. Both age and gender were found to be significantly correlated with depth of processing and a number of the dependent variables in the current studies, for example: future research should identify the mechanisms at play. A further example of a boundary condition worthy of further investigation is whether making someone aware of the fact that they are feeling disgust/serenity will attenuate the impact of these emotions on lower depth of processing, as has been shown in past incidental mood research (Angie et al., 2011). Individual differences such as conscientiousness or neuroticism (Goldberg, 1993) might also function to reduce or increase the impact of emotions on depth of processing. Examination of the moderating role of these individual difference variables all offer interesting future directions for research.

5.4. Concluding remarks

The body of research described in the thesis demonstrates that the selection of images that accompany written messages matters. In the context of sustainable urban stormwater management, embedding images that elicit disgust or serenity can have a detrimental effect on the degree to which a significant proportion of the target population (that is, people less involved in pro-environmental issues) will pay attention to the message, and this flows on to how engaged they are

with the topic. Furthermore, the results of the Study 4 suggest the importance of including information (e.g., self-efficacy information) that aligns with the motivational goal of any emotions elicited (e.g. sadness). Importantly, the thesis research findings suggest that past research on the role of incidental emotions on message processing successfully translates to integral emotions and can therefore be used more confidently when designing communication campaigns that may involve the elicitation of integral emotions.

Whilst this research focuses on the role of external simple images, in reality a combination of communication techniques would be required to more fully engage a community with a pro-environmental policy or project. However, the core aim of the current research program is to assess the contribution of images within the wider, communication and engagement toolset. I hope that these findings will serve as a useful guide for practitioners who work within this context, and that the thesis encourages future experimental research exploring the role of images in the creation of successful pro-environmental communication campaigns.

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APPENDICIES

Appendix A: Ethics approval for Study 1

THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

Institute for Social Science Research

Postgraduate Administration and Unit Publications
Dr. Lisa Pope
CRICOS PROVIDER NUMBER 00025B

26 March 2015

Tracey Shultz
Institute of Social Science Research

Dear Tracey,

The Institute for Social Science Research Higher Degree Ethical Review Committee has considered your application for approval of the project titled, "Exploring Community Perceptions of Images of Urban Storm Water Management".

I am pleased to report that the panel has granted ethical approval of the project, subject to incorporation of appropriate procedures to deal with some points raised during review. There is no need for this to be referred back to the ethics committee.

Your approval number is ISSR:26032015.EA05.

Please discuss the following point with your supervisory team, and amend the research collection procedures accordingly.

The application and PIS outline that the sorting task undertaken by the participant will be audio recorded. Will the recording be transcribed, and if so will a transcription service be used? Please consider how confidentiality will be protected if this is undertaken. If the researcher is carrying out the transcription please include a statement to this effect in your documents to the participants.

We wish you all the very best with your research.
Please contact myself or Professor Janeen Baxter should you have any further queries.

Sincerely,

Lisa Pope

Lisa Pope
Postgraduate Administration Officer

Appendix B: Ethics approval for Studies 2-5

Tue 23/02/2016 1:46 PM

Thomas Suddendorf

Re: Ethics Application for review Tracy Shultz

To Tracy Schultz

Cc Psychology Ethics; Kelly Fielding

You forwarded this message on 25/01/2017 12:13 PM.

Dear Tracy

Thank you for submitting the Psychology Student Research Ethics Review Applications form for the project:

Engaging people with pro-environmental policy initiatives through the use of visual images

Based on the information you have provided I have given the study ethical clearance. Please pardon the delay.

Your ethical clearance number is: 16-PSYCH-PHD-07-TS

Good luck with your project

Kind regards,

Thomas

Professor Thomas Suddendorf, PhD, FAPS

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Appendix C: Discrete emotions, synonyms and cognitive appraisal

Emotion	**Synonyms**	**Certain**	**Uncertain**
fear	fear, horror,		X
anger	anger, annoyed, bothered, pissed off	X	
guilt	guilt, shame, responsible	X	
sad	sad, depressed, disappointed, distressed, upset, dismay, disheartened		X
disgust	disgust, yuck, gross	X	
surprise	surprise, shock		X
positive affect	happy, good, amazing, nice, warm, inspired, pleasant	X	
serene	serene, calm, relaxed, peaceful, tranquil	X	
negative affect	bad, terrible, uneasy, not happy, disturbed, helpless, not good		X
worry	worry, concern, nervous		X
bored	bored, indifferent, uninterested	X	
no emotion	no different, same, no feeling, none, normal, nothing, neutral		
interest	interest, curious		

Appendix E: Factsheet used for Study 2 and 3

MANAGING STORMWATER IN CITIES AND TOWNS FACTSHEET

Outside of cities, rainfall can soak into the ground and become a source of water for plants and a way of topping up groundwater. In built up areas, however, there are many non-porous surfaces, like concrete paths, roads and roof-tops; rainfall runs off these surfaces and becomes stormwater.

As stormwater flows across these hard surfaces and enters drains, it can become polluted with litter, chemicals, and soil particles. This is because the stormwater system is separate from the sewer system and is not treated. The polluted stormwater eventually flows into oceans and waterways where it causes harm to plants and animal life. For example, chemicals, like nitrogen and phosphorus, can cause toxic algae blooms. Stormwater runoff can also cause flooding and erosion problems.

Local authorities or water utilities can better manage stormwater by...

- Installing porous paving that allows stormwater runoff to soak into the ground;
- Constructing greenwalls on the outside of buildings so that the plants can filter out the pollution from roof runoff before it enters drains and underground pipes; and
- Using wetlands, either natural or artificial, to collect and filter stormwater before it enters our waterways.

Community members can better manage stormwater by...

- Installing rainwater tanks to store water for later use and to reduce the amount of stormwater entering waterways;
- Installing raingardens to capture and filter stormwater before it enters waterways; and
- Washing cars on the grass to limit the amount of detergents, mud and oil entering waterways.

Appendix F: Factsheet used for Study 4

Types of stormwater pollution

There are four main types of stormwater pollution:
1. litter, such as cigarette butts and plastic bags
2. chemical pollution, such as detergents, oil or fertilisers
3. sediment pollution, such as soil erosion from building sites and unsealed roads
4. organic matter, such as leaves, garden clippings or animal droppings

What causes stormwater pollution?

Typical activities that can cause stormwater pollution are:
1. dropping litter where it can be swept into drains by wind and rain
2. not disposing of chemicals correctly and allowing them to enter stormwater drains
3. washing your car on a paved surface causes detergent to run directly into drains
4. allowing organic matter to accumulate in places where it ends up being blown or washed into drains

Effects of stormwater pollution

Stormwater eventually flows into our oceans where it causes damage. For example:
1. litter destroys the natural beauty of our oceans
2. the chemicals in stormwater pose a health risk to humans as it can be dangerous to swim in the ocean immediately after rain
3. soil sediment kills fish by clogging their gills
4. when organic matter decays in water it uses up oxygen, taking oxygen away from plants, fish and other aquatic animals

Appendix G: Factsheet used for Study 5

How much plastic is in oceans?

More than 8 million metric tonnes of plastic waste are deposited into the ocean each year.

How does the plastic get into the ocean?

Incorrectly disposed of plastic travels from land to the ocean by being swept through stormwater drains when it rains. This is because stormwater is not treated and therefore the plastic is not filtered out.

How does plastic affect the ocean life?

Animals can become entangled in plastic, this includes turtles, seals, penguins and fish. Animals can also eat the plastic which contains toxins. This can cause health problems to the animal itself and the toxins can end up in the human food chain.

What can you do about it?

1. Use less plastic (e.g., take reusable bags when shopping)
2. Encourage government to introduce a ban or levy on plastic bags
3. Ensure that plastic is disposed of correctly in the bin
4. Do not buy bottled water

What can your local government or local water authority do about it?

Proactive steps include installing infrastructure, such as pollutant traps, raingardens or wetlands, which filter out the plastic before it reaches the ocean.